MAY 1956 – SIXTY-SECOND YEAR

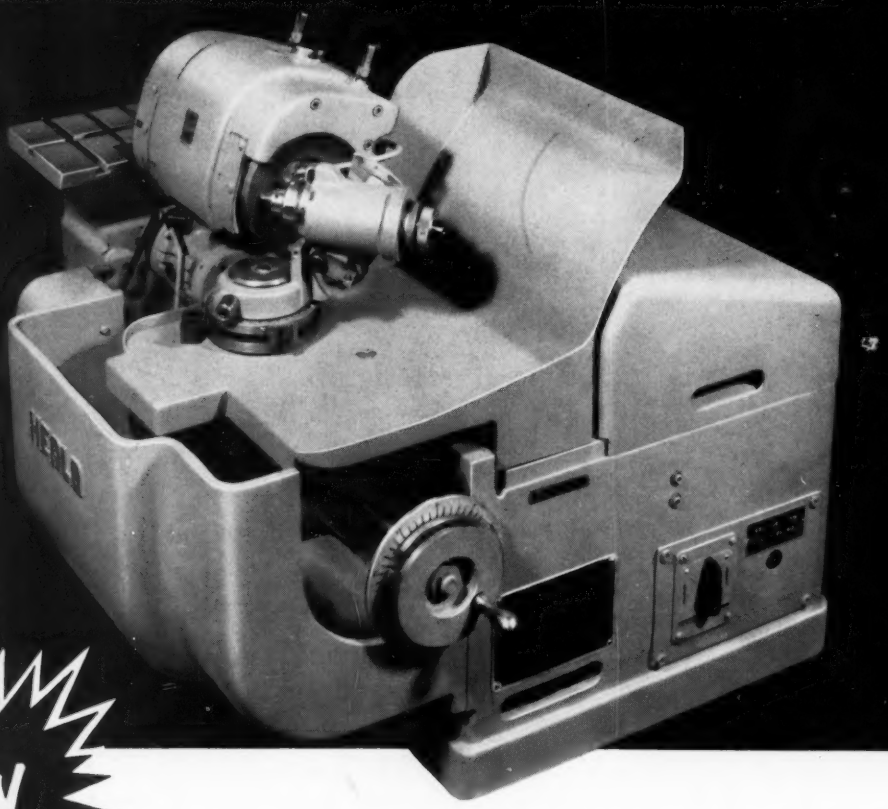
MACHINERY

Up to 33⅓% more efficiency!

For turning, forming, one-chip finishing to 0.0005", the Brown & Sharpe No. 00 Automatic Screw Machine is the fastest automatic in its range . . . *and by far the most efficient!* Speedier set-ups and increased productivity permit *three* No. 00's to do the work of any four older machines . . . with higher sustained accuracy, reduced maintenance . . . up to 33⅓% greater overall efficiency. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

B·S
Brown & Sharpe

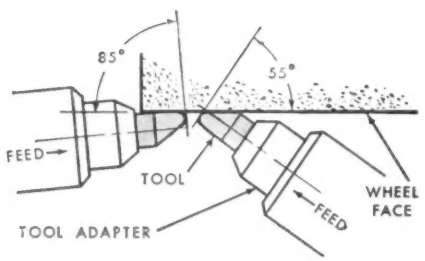
sharpen your tools with MACHINE PRECISION



new

HEALD MODEL 3 TOOL SHARPENER

saves time, gives longer tool life, permits faster, more efficient borizing



The oscillating tool holder swings through an arc of up to 150°, to grind a maximum side angle of 85° on one side of the tool and 55° on the other side. Front clearance angles are adjustable from −10° to + 30° and tool radius can be set anywhere from 0 to 1¾". Precision calibrated scales eliminate guesswork and the mechanical machine cycle avoids any possibility of human errors or inaccuracies in the grinding operation.

LET's face it. Off-hand grinding just isn't precise enough for modern, high-speed borizing tools. To obtain maximum borizing efficiency, tools must be of the *precisely correct shape*—in complete conformity with *design specifications*.

With the new Model 3 Tool Sharpener, this requirement is met—and easily. Just dial the desired tool shape on the calibrated scales, clamp the tool in the holder and press the start button. Tool holder oscillation and wheel reciprocation are mechanically controlled, grinding up to five different angles and the radius with only an occasional hand adjustment for feeding the tool against the wheel. Precision is far greater than obtainable by off-hand grinding. What's more, any desired tool shape can be *exactly duplicated* again and again.

The mechanical precision built into this improved Model 3 machine assures a sharp, flawless cutting edge that will produce more and better work per sharpening. For complete details, send for Bulletin 2-4-2. IT PAYS TO COME TO HEALD!

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Subsidiary of The Cincinnati Milling Machine Co.

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MACHINERY

Volume 62 MAY, 1956 NUMBER 9

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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3/4"- 4.320" threading range

. . . with one LANDMACO Machine

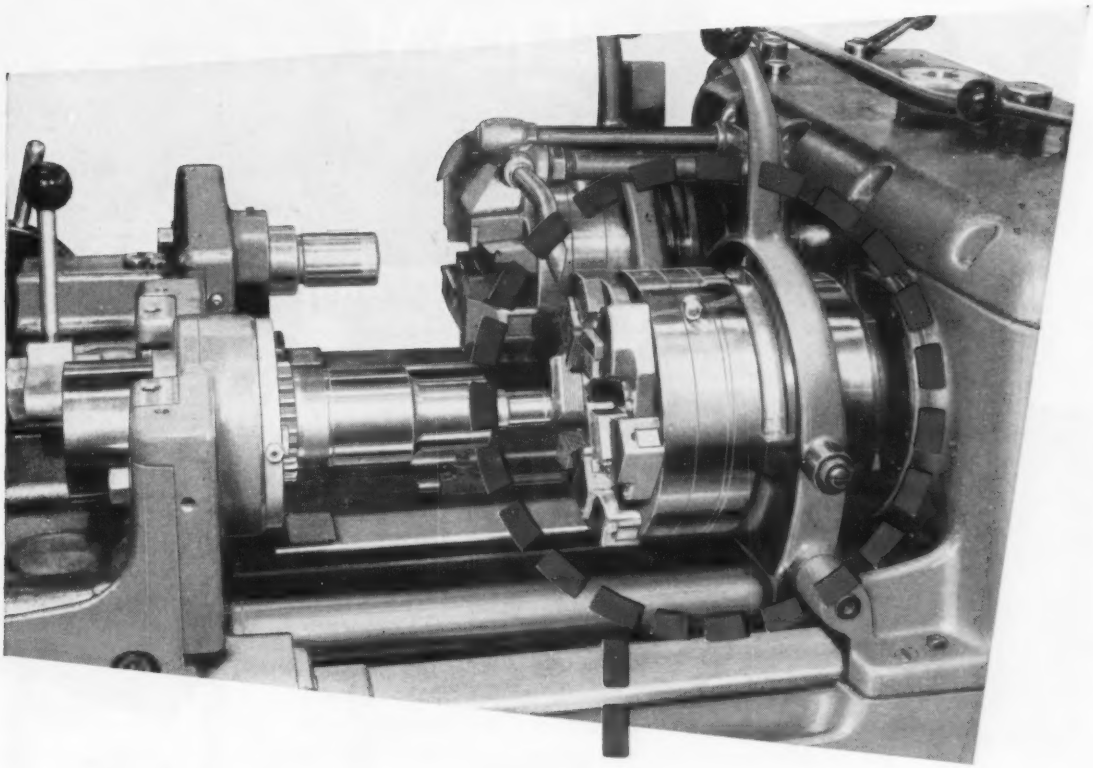
The Twin Disc Clutch Company Hydraulic Division in Rockford, Illinois, is able to thread a wide variety of work from 3/4"-32 pitch to 4.320"-12 pitch with just one LANDMACO Threading Machine.

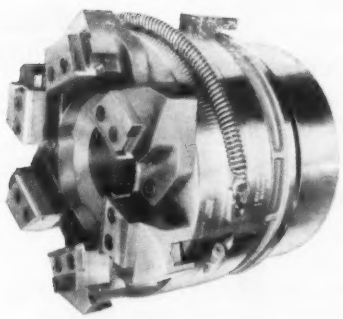
A six-chaser 40RX LANCO Head with a range of 2½" to 9¼" (5-1/8" bore) is mounted on the right-hand spindle to produce fine-pitch large-diameter threads. A 2½"R LANCO Head with a range of ½" to 2½" is used on the other spindle to produce coarse-pitch threads, small-diameter threads, and long thread lengths.

One of the many different operations performed by this equipment is illustrated—threading clutch output shafts with the 40RX Head. The workpiece is made from C1045 steel, heat-treated to 229-269 Brinnell hardness. A special 12-pitch UN Thread, with a 3.669"-3.676" pitch-diameter tolerance, is cut .830" long to within ¼" of the shoulder. 15 pieces are threaded per hour, including 100% inspection by gauging on the machine. Even with heat-treated material and exacting thread finish requirements, 100 pieces are completed between chaser grinds.

The different types of special workholding fixtures designed for these short-run operations at Twin Disc are a major factor in the versatility of the equipment used. For example, in the operation illustrated, a special carriage front allows this LANDMACO Machine to thread a workpiece with a diameter well beyond its normal range. These special fixtures may be used interchangeably with the standard vises.

This installation shows how LANDIS Equipment and Engineering can combine to economically solve a problem in Thread Production. May we suggest the most efficient method for producing your Threads?





For additional information:

* on the many types and styles of LANDIS Die Heads, ask for Bulletins F-80 or F-90
* on LANDMACO THREADING Machines, ask for Bulletin H-76.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT • CUTTING • TAPPING • GRINDING • ROLLING

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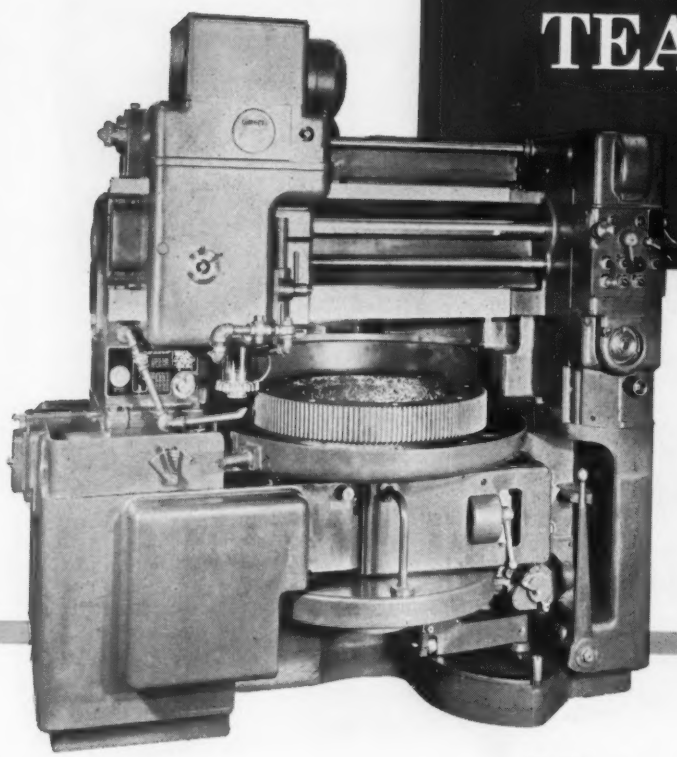
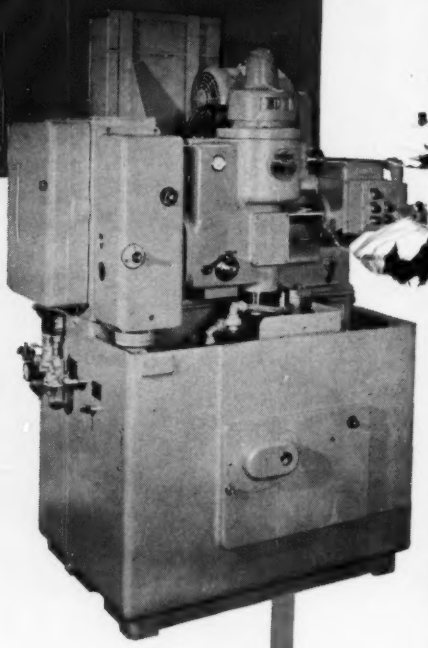
HIGH-PRODUCTION TEAM . . . . . .



Fellows 36-Type Gear Shaper:

produces gears up to 36" p.d., 6" face width.



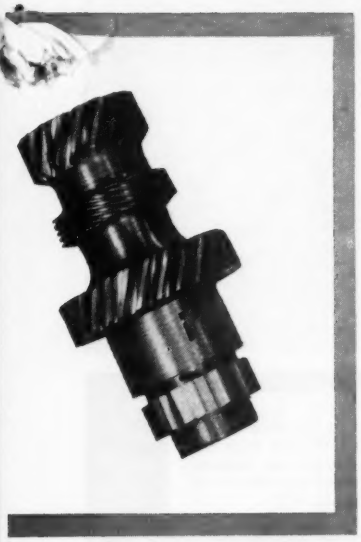
Fellows No. 4 GS Gear Shaper:

produces gears up to 6" p.d., 2" face width.

THE PRECISION LINE

. to meet your gear-cutting needs

. . . up to 36" p.d.



With these two high-speed, close-tolerance machines you can cover the whole range of your spur and helical gear production requirements . . . offering maximum capacity at a reasonable investment.

The new Fellows No. 4GS Gear Shaper finish-cuts internal and external spur and helical gears up to 6" p.d. and 2" face width, at 9 cutter speeds from 98 to 635 strokes per minute! It can be used for general purpose gear cutting or adapted to semi-automatic or completely automatic operation for large production runs. Rigid mechanism assures high speed with close tolerances. Rotary feeds from 0.008" to 0.028" based on 4" p.d. cutter

The Fellows 36-Type is a powerful machine that can hold close tolerances while taking extra heavy cuts on internal or external spur, helical, or herringbone gears up to 36" p.d. and 6" face width. Cutting speeds from 18 to 300 strokes per minute. Matched to modern needs for fast set-ups and quick, easy adjustments. Versatility permits wide-spread use cutting cams, splines, and special contours, too.

Get full information about this profitable team from your Fellows representative. And ask him about the Fellows Plan for deferred payment. WRITE, WIRE or PHONE any Fellows Office.

● THE FELLOWS GEAR SHAPER COMPANY,
78 River Street, Springfield, Vermont.
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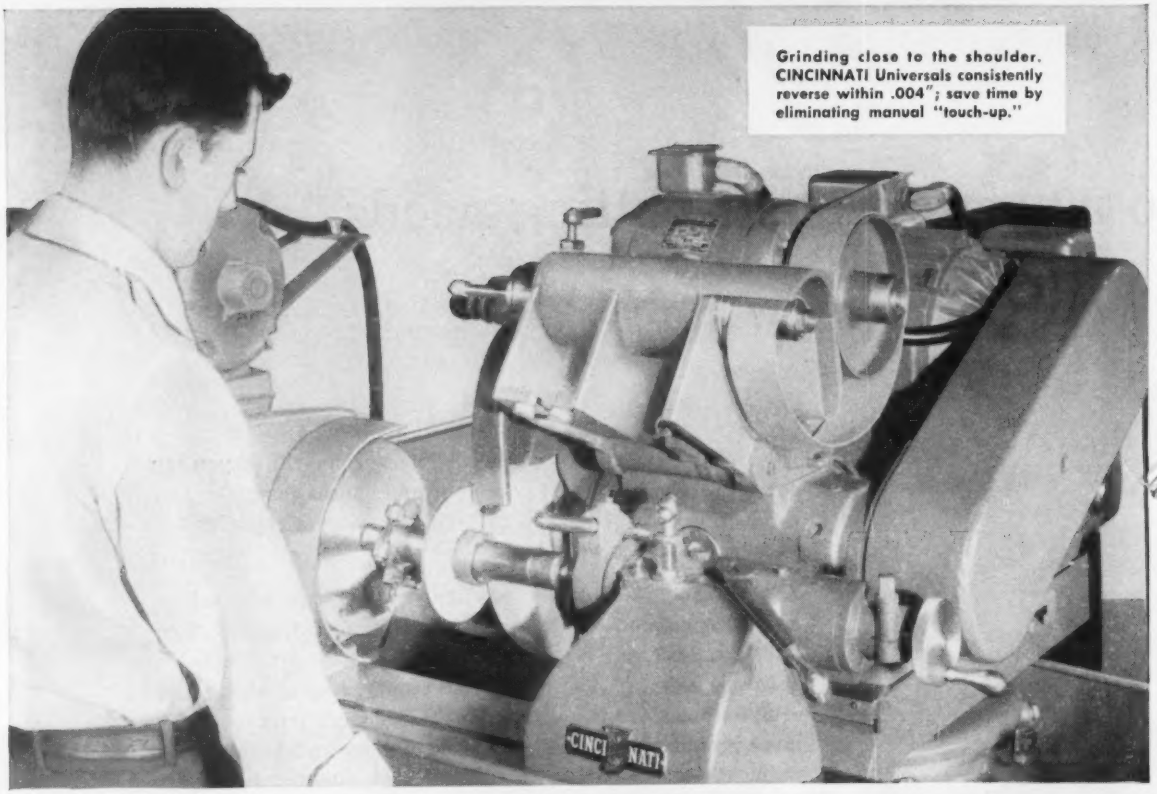
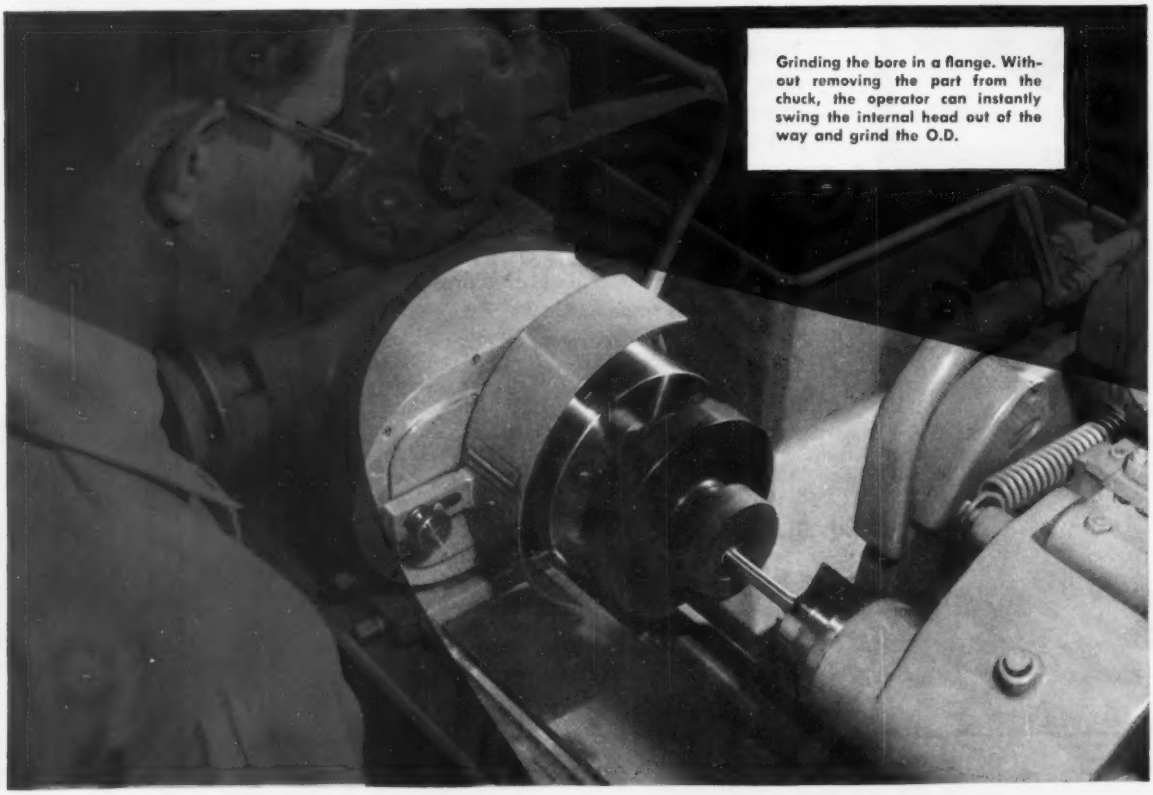
Fellows *Gear Production Equipment*



Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."



Grinding the bore in a flange. Without removing the part from the chuck, the operator can instantly swing the internal head out of the way and grind the O.D.

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

Cincinnati's setup timesavers

reduce cost of your small lot precision production

Setup time looms large in the cost of small lot production. Whatever you do to reduce it helps everyone in the shop. To keep this element of cost at the lowest possible level, new CINCINNATI® FILMATIC Universal Grinders are equipped with many features. Just consider the possibilities of these four:

1. Hinged Internal Grinding Head —swing it down and tighten one bolt—that's all
2. FILMATIC Grinding Wheel Spindle Bearings—require no adjustment for any quality of finish or stock removal
3. Speed Ranger Headstock Drive —instantaneous finger-tip selection of infinite number of speeds; A.C. motor
4. Standard Headstock Spindle Nose—receives standard lathe chucks; quick change adapter available

Other ways in which new CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI® FILMATIC 12" X 36" UNIVERSAL GRINDING MACHINE

CINCINNATI

FILMATIC

CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

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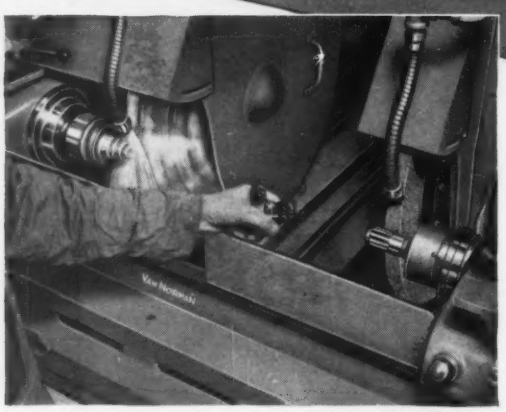
VAN NORMAN

Van Norman "Bowgage" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheel: 30" x (¾ to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.



Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 — .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

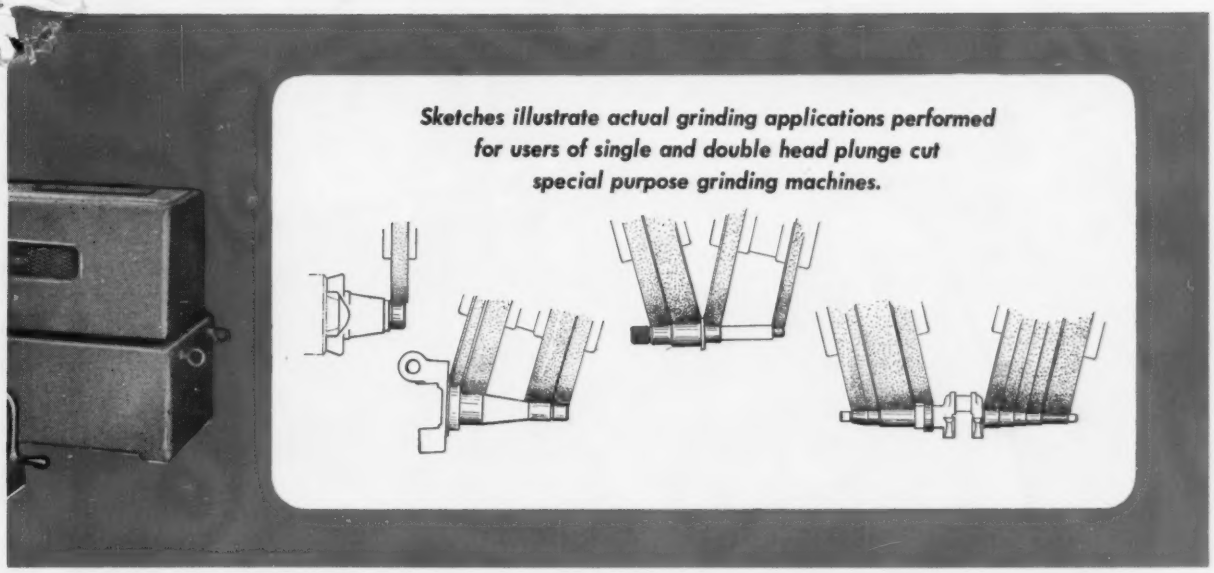
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

"BOWGAGE" PRODUCTION GRINDERS

"Engineered for the Job"

Outperform Them All For Speed, Accuracy and Low Cost Grinding



Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.

You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman Engineers help you solve it. Write for their help, today.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

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COMPANY

SPRINGFIELD 7, MASSACHUSETTS

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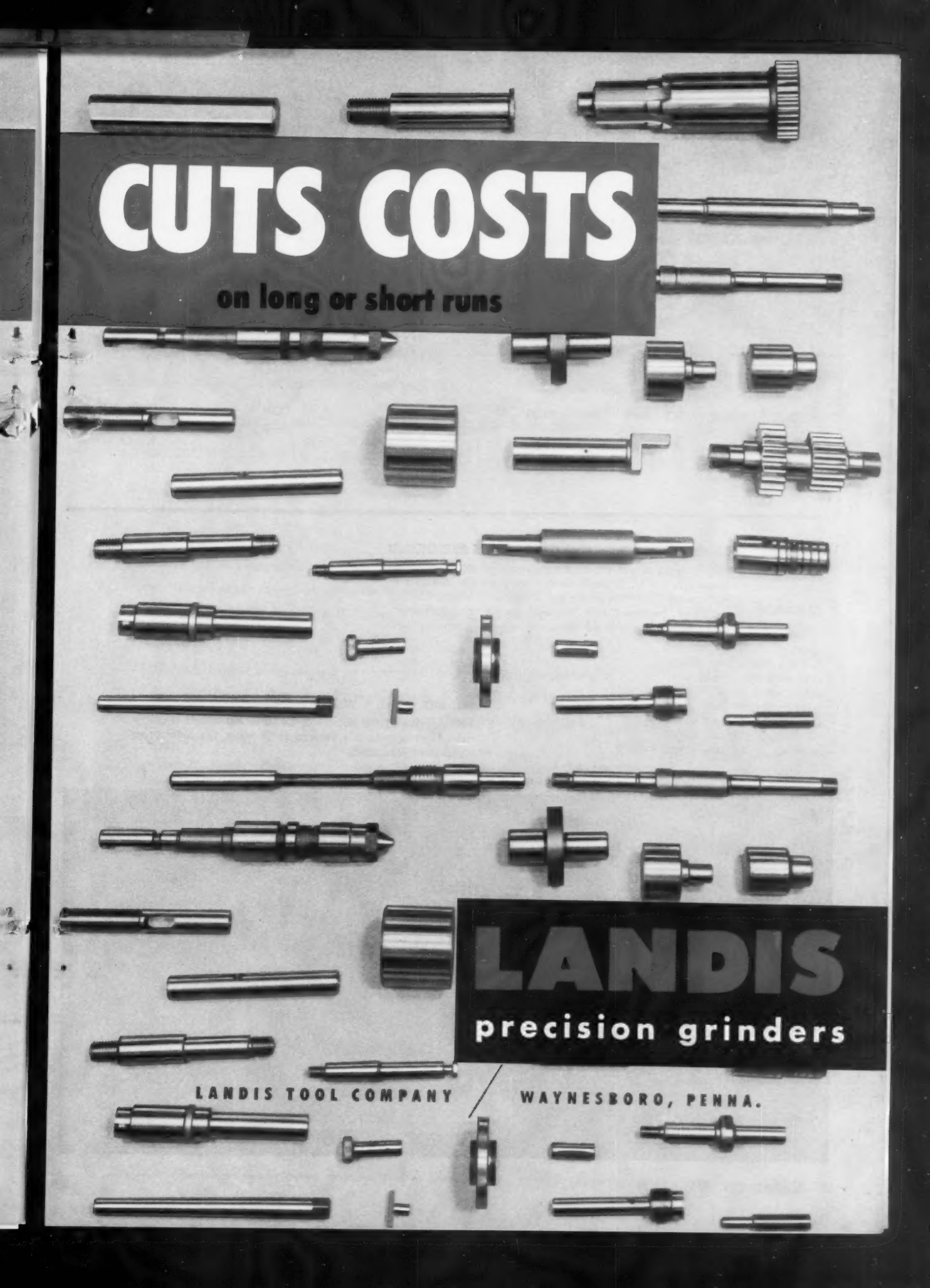
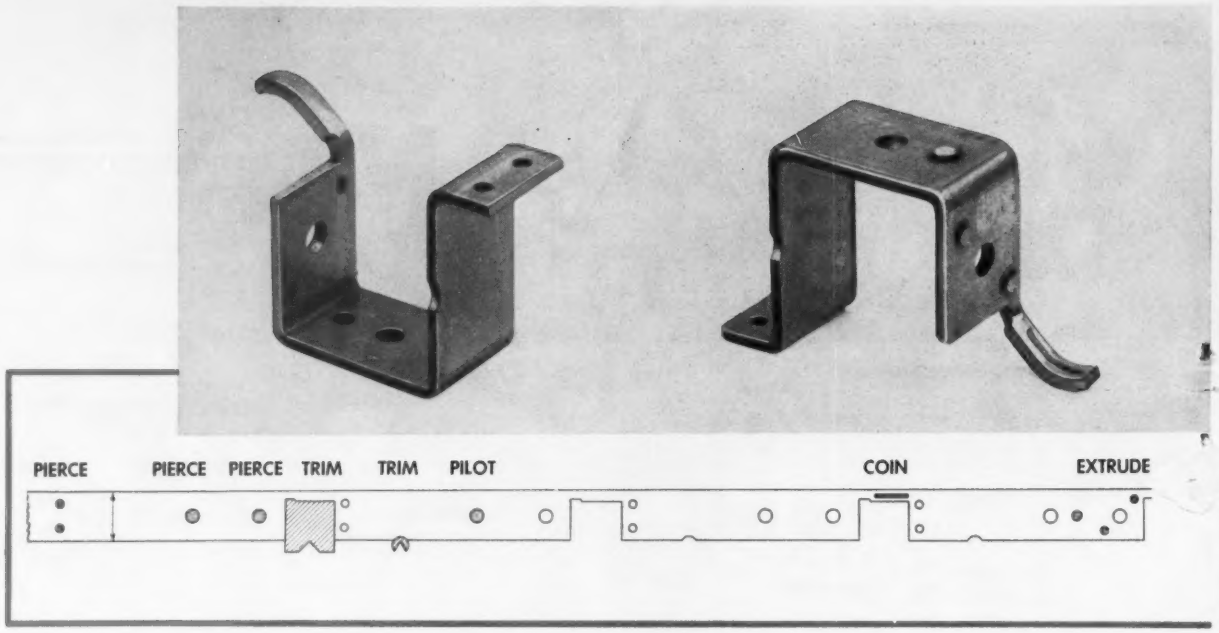
4" Landis Plain Grinder


CUTS COSTS
on long or short runs
LANDIS
precision grinders
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

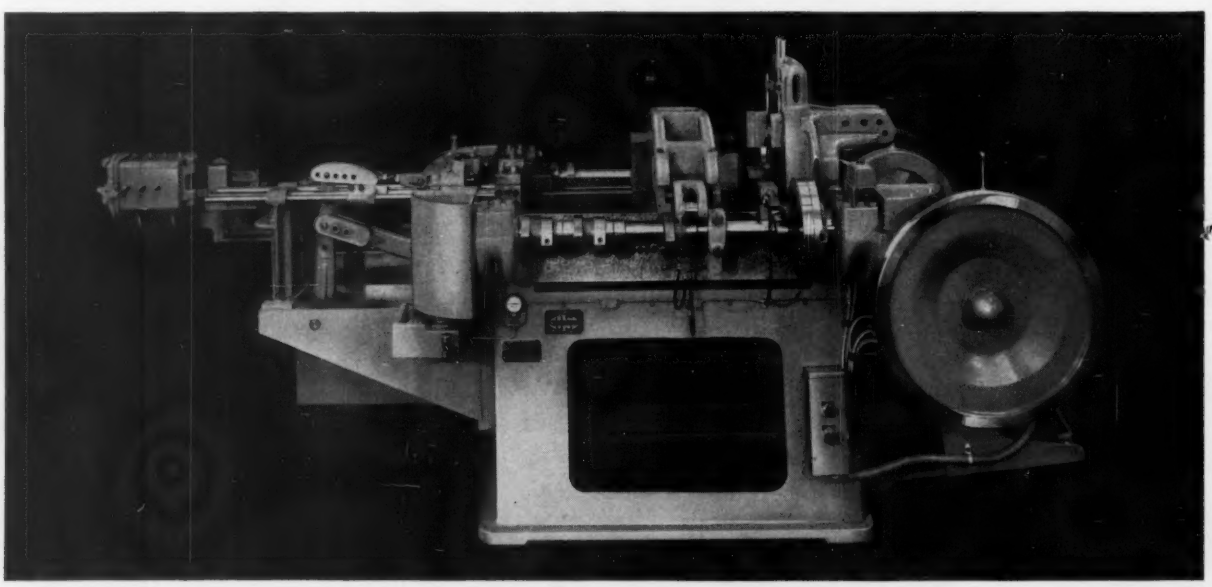


SEQUENCE STRIP SHOWS OPERATIONS PERFORMED

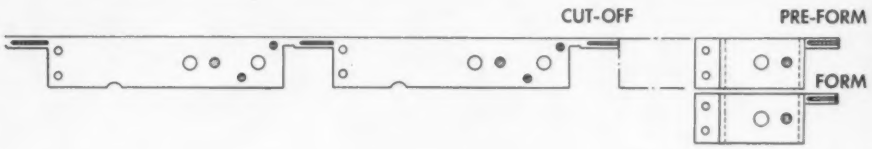
The drawing above shows the sequence of operations performed in the U. S. Multi-Slide to produce the automotive component illustrated at the top. Piercing, trimming, coining, extruding, cutting-off and two-level forming are performed, and the part is produced complete, without secondary handlings.

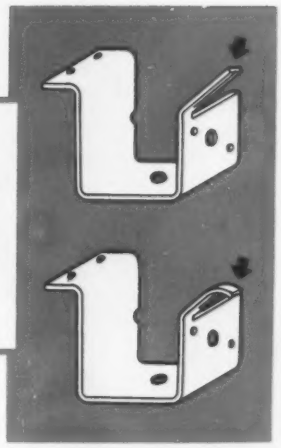
THE NO. 33 U. S. MULTI-SLIDE

Below is shown the basic No. 33 U. S. Multi-Slide which is used (with appropriate tooling) to produce the automotive component illustrated.



MULTIPLE OPERATIONS ON U. S. MULTI-SLIDES® MULTIPLY PROFITS





TWO-LEVEL FORMING

A two-level forming position is used to produce the automotive component. The top view, above, shows the preform obtained in the upper level, and the lower view shows the finished form obtained in the second or lower-level forming position.

Each secondary operation eliminated means reduced piece part costs. You, like all other manufacturers, are striving to attain this end result. In the production of formed metal stampings from coil stock, the U. S. Multi-Slide may be the answer.

U. S. Multi-Slides are designed primarily for the automatic production of precision formed stampings from coil stock. Many different types of stampings ordinarily requiring secondary handlings can be produced complete on the Multi-Slide.

The part illustrated on these pages is a component for an automotive manufacturer and is produced complete without secondary handlings. The sequence of operations is pierce, trim, coin, extrude, cut off and form (2 levels). This automotive component is just one of many different types of stampings which can be produced complete on the U. S. Multi-Slide.

If stampings are included in your production program, why not ask for a copy of Bulletin 15M illustrating and describing the four sizes of U. S. Multi-Slides we now build.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories
Builders of U. S. Multi-Slides—U. S. Multi-Millers

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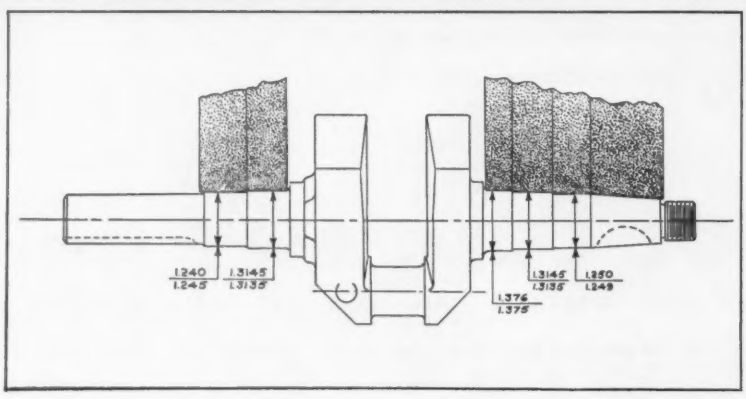

IN WISCONSIN MOTOR CORPORATION'S MILWAUKEE PLANT, crankshafts are ground on a Norton Type CTU-HD 10″ semiautomatic heavy duty cylindrical grinder for approximately half what this job formerly cost. Diagram shows six simultaneous grinding operations: two diameters by wheel on left, three diameters and taper by wheel on right.

The "WISCONSIN STORY"...

Wisconsin Motor Corporation, leading manufacturers of heavy duty air-cooled engines, reports:

with this Norton Heavy Duty Grinder

Type CTU-HD machine in Milwaukee plant grinds crankshafts faster and better — at one-half previous cost!

Wisconsin Motor Corporation's endorsement of the Norton Type CTU-HD cylindrical grinder is echoed throughout industry. In plenty of other modern plants this highly advanced, heavy duty machine is doing an outstanding job of boosting production rates and profit margins.

A single 10" Type CTU-HD — or 14" Type LCTU-HD, with increased swing — replaces several separate old-type grinders. It accommodates multiple wheels widely spaced, making it ideal for many plunge cut operations. Or it will take large diameter wheels, essential on such jobs as grinding crankshaft bearings, in order to permit adequate wheel wear before interference with parts of the work.

Semiautomatic or Plain

The semiautomatic arrangement provides an adjustable, automatic grinding cycle under one-lever control. The operator merely loads and unloads, and so can handle more than one machine. Except for this feature the plain machine is identical, and both machines are arranged for fast traverse grinding.

Simplified Operation and Maintenance

All controls for feeds and speeds are set in front of machine. Wheel feed is by a precise revolving screw mechanism with click-count index, by which settings for .0001" in work diameter reduction can be made instantly, without visual check. Controls of work rotation and coolant flow are automatic. Pumps, motors, filters, relief valves, ways lubricant control valves are all outside, for easy maintenance.

For Complete Details

see your Norton Representative or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels — your assurance of the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

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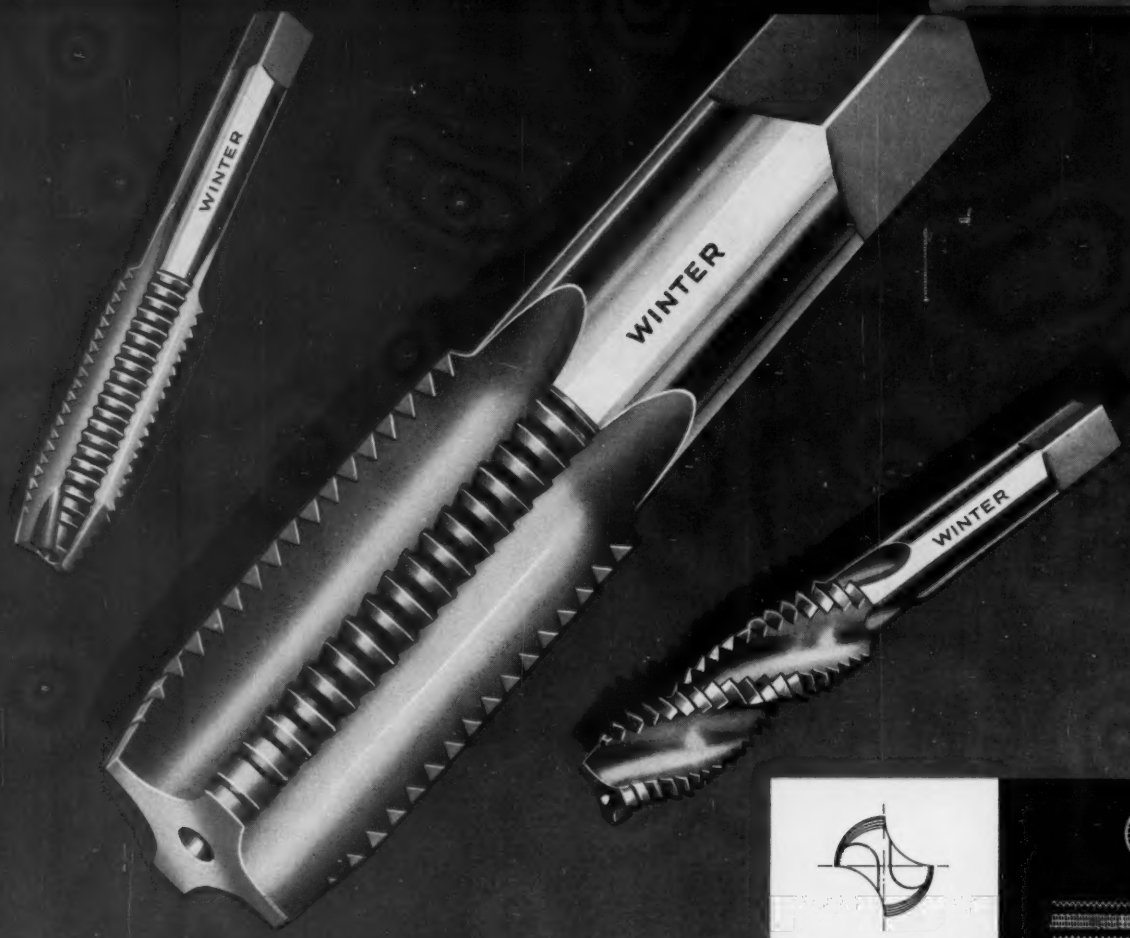
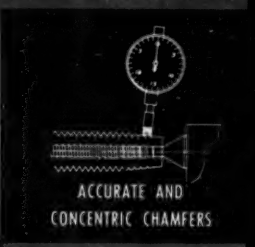
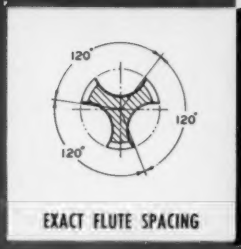


PRECISION CHIP DRIVER CONTOURS


ACCURATE AND CONCENTRIC CHAMFERS



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UNIFORM FLUTE CONTOURS

FOR A PRODUCTION BONUS—

BALANCED ACTION

There are many mechanical and technical superiorities in the design and manufacture of Winter Balanced Action Taps. These give you a production bonus in size control and in prolonged tool life.

CALL YOUR WINTER DISTRIBUTOR

WINTER

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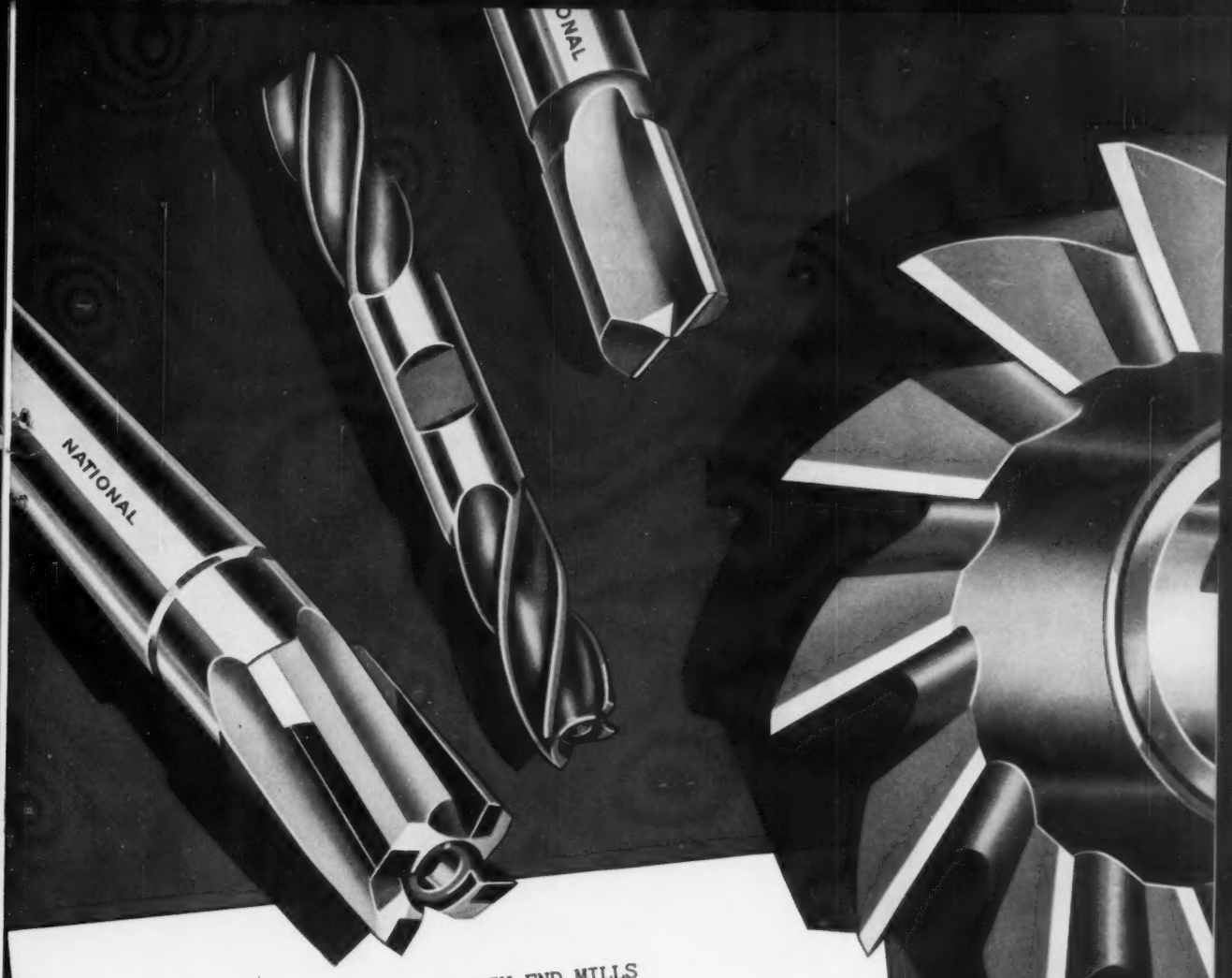
Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.



WHATEVER YOU REQUIRE IN END MILLS

A wide range of End Mill styles and sizes are immediately available from National stocks. We also design and make End Mills for many special applications. When applications call for laboratory research, write our Engineering Department.

Now available – a new catalog of National carbide tools.

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE AND SPECIAL TOOLS

CALL YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

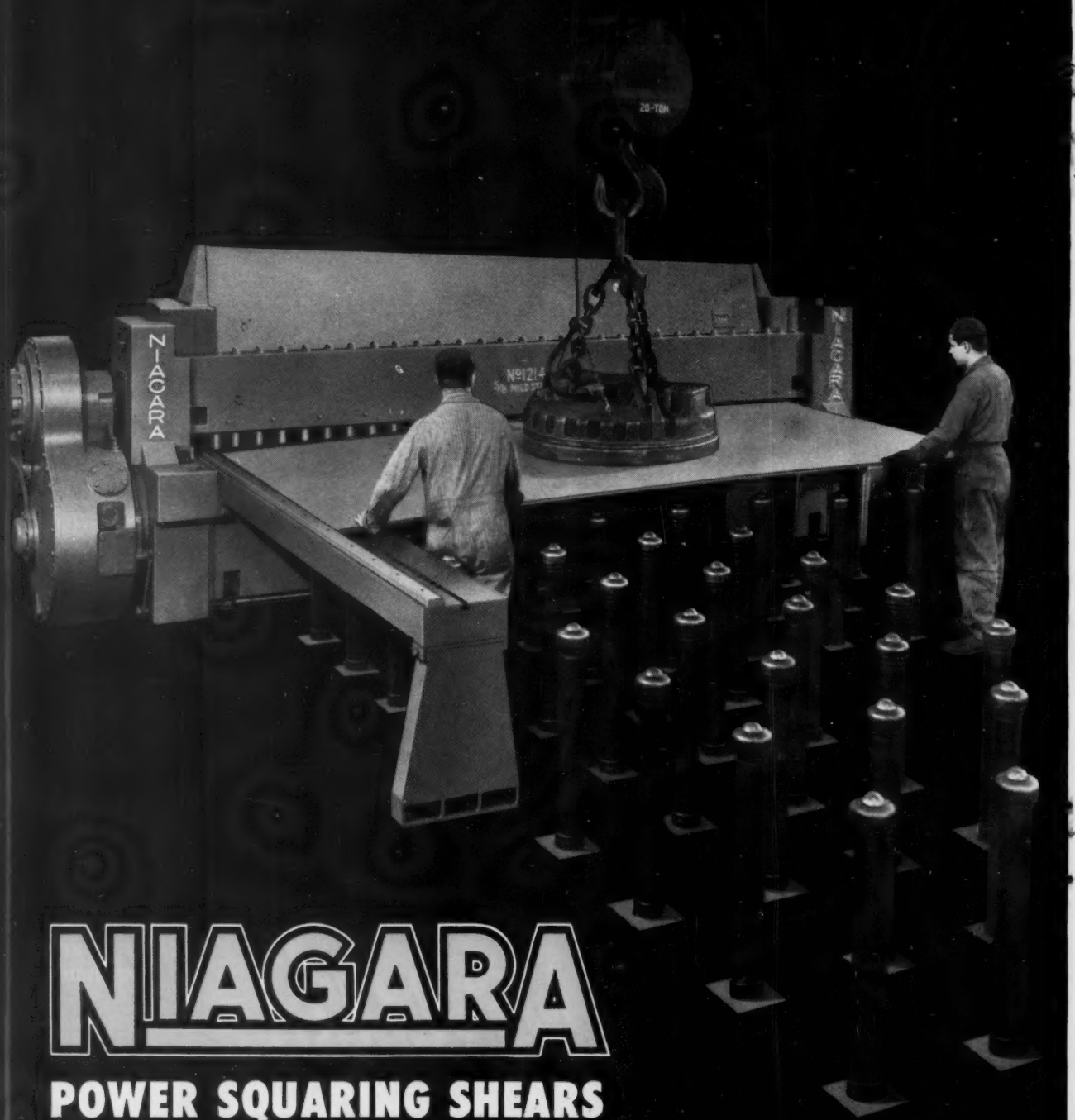
National

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

America's oldest shear builder

the most in accuracy, speed



NIAGARA

POWER SQUARING SHEARS

offers you

and thrifty performance

One of the greatest values of a Niagara Power Squaring Shear is the unequaled experience of its builder. Niagara has been making shears for more than 75 years . . . by far, the longest of anyone in the industry.

Today, as in the past, the oldest name in shears stands also for the most modern in shear design. Niagara has continually set the pace in offering the most of **things which count the most** in dependable shear performance.

why YOU GET THE MOST IN ACCURACY:

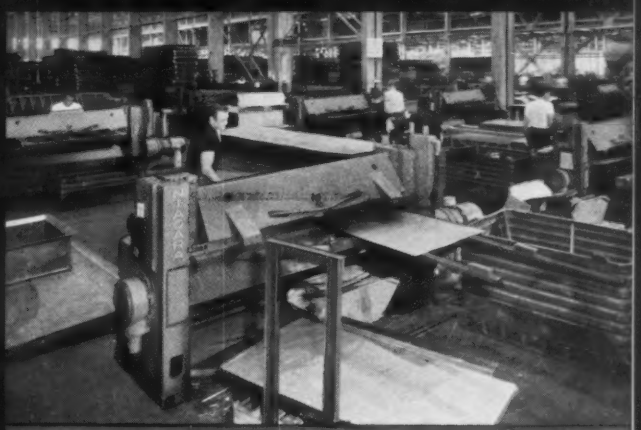
- With the cutting line fully visible, the positive power actuated, self-compensating holddown grips work securely. Multiple pressure feet on 6" centers apply uniform pressure, contacting the work with low impact to safeguard material and bed against damage. Long or short work is held tight against the bed. There's no rippling of the sheet as the keen edged, low-sloped upper knife shears through . . . clean and smooth.
- Niagara's fully closed box section construction of bed, crosshead, holddown and housings plus ample and accurately held crosshead guides resist horizontal, vertical and torsional stresses with minimum deflection.
- Edges are trimmed straight and true within micrometer tolerances. Blanks, too, are cut accurately to size and shape without making compensating allowances when setting gages. Only a Niagara Shear possesses **all** of the necessary features to insure maximum accuracy!

why YOU GET THE MOST IN SPEED:

- More working strokes delivered per minute and instant engagement of the Niagara Sleeve Clutch assure more cuts per hour. In continuous feed shearing, quick release of the power driven holddown enables a strip to be cut at each stroke.
- There's no need to adjust knife clearance every time a different thickness of stock is cut. Individual holddown feet are self-compensating. Two sheets of different thicknesses can be cut at the same time with the same knife adjustment and with the same accuracy.
- Ease of operation, quick setting gages and confidence inspired by safety features further increase hourly output . . . and make a Niagara Shear a truly productive, profitable investment for you!

YOU GET THE MOST IN THRIFTY PERFORMANCE:

- Simplicity of design, involving a minimum number of parts, cuts out costly maintenance. With less to go wrong, there's less to repair and replace.
- Vital parts of Niagara's driving mechanism (clutch, gearing, flywheel, eccentrics and detent) operate in enclosed oil-tight cases. Ideal lubrication and maximum safety are thus insured.
- With power transmitted from the drive through efficient spur gears and Niagara's instant engaging, multiple-point sleeve clutch, there are no sliding surfaces (such as in worm gears and friction clutches) to consume power, generate heat and wear rapidly.
- Niagara 4-cutting-edge knives, manufactured entirely within the Niagara plant, are uniformly tough to withstand hard usage and are promptly available.



Niagara Shears at work in Ohio plant of one of the major electrical appliance manufacturers.

MOST EXACTLY SUITED TO YOUR NEEDS, TOO!

To fit your requirements exactly, consult a Niagara representative. With over 7 dozen models available in capacities from shim stock to 1" mild steel and in cutting lengths from 3 to 24 ft., he'll be able to recommend the shear that's **right** for you.

ILLUSTRATED, FACT-FILLED BULLETIN 69 MAILED FREE ON REQUEST

It will give you detailed information on the complete, modern line of Niagara Underdrive Squaring Shears. Write for your copy today.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N.Y.

DISTRICT OFFICES

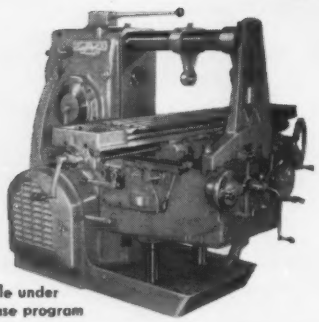
BUFFALO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.

COMMON SENSE
SAYS IT'S BETTER...

Think it over... twin screw knee support is the one really new basic advancement in knee type milling machine design in years. And only Kearney & Trecker new TF Series machines have it!



Available under Tool-Lease program

TF Series Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ⅜ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

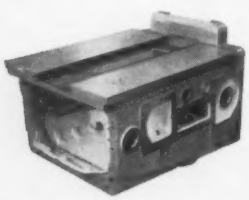
Here's why it makes sense.

Because the *twin screw* design distributes most effectively the weight of much larger, heavier knees, saddles and tables, it fulfills today's requirements for higher speeds, feeds and power — greater machine capacity. What's more, this *balanced design* substantially increases stability under heaviest loads... offers greater resistance to torsional thrust under all cuts... divides the wear factor in half, thus assuring greater, longer-lasting accuracy.

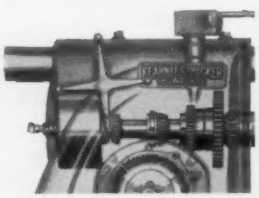
Kearney & Trecker's feature-packed TF Series line of general production machines is available in five sizes — No. 2 to No. 6, from 10hp to 50hp in Plain, Universal and Vertical styles.

Why take less than the latest when you want new milling machines? You can get all the facts on the new TF's from your Kearney & Trecker representative, or write direct to Kearney & Trecker Corp. Mail coupon for new catalog with details on TF Series machines.

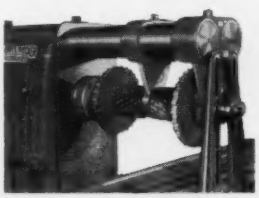
5 more reasons why TF Series milling machines are way out front in rigidity



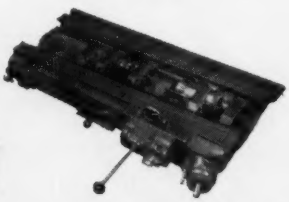
Heavier, Wider, One-Piece Knee — The *Twin Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, fly-wheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.



Double "Vibra-Void" Overarms—Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection. Design also greatly simplifies changing of arbors and cutters.



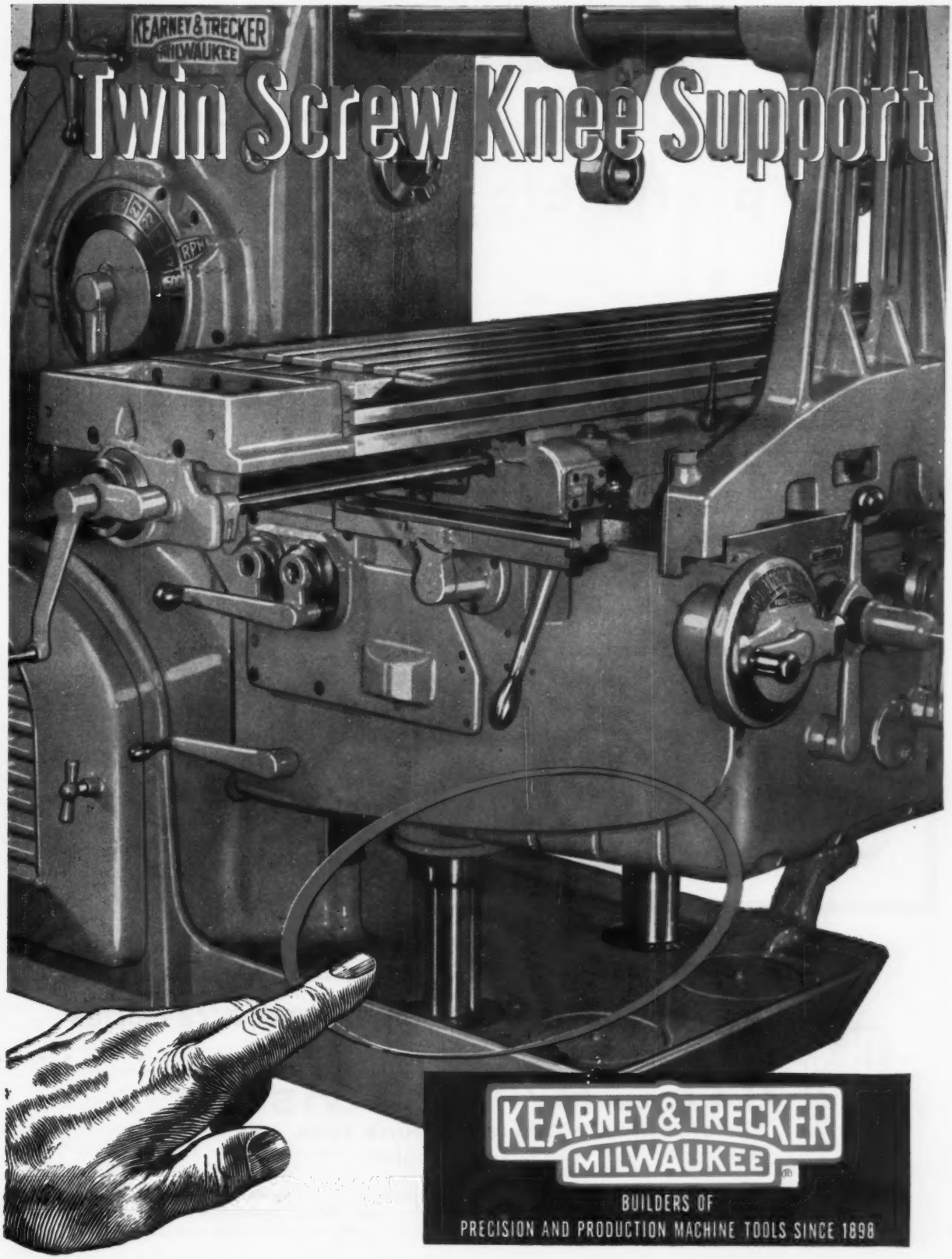
"Fron-Trol" Operating Convenience—Front-mounted controls include feed selection, Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, table handwheel, levers for saddle clamping gib and backlash eliminator. All are grouped up front for easy operation. All machines are equipped with heavy-duty (2" dia.) table feed screw.

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....
Title.....
Company.....
Address.....
City.....Zone.....State.....



For more information fill in page number on Inquiry Card, on page 219

Today's *Smartest* approach to more profitable metalworking

UNLIMITED profit-making opportunities begin with Giddings & Lewis 300-T (table-type) horizontal boring, drilling and milling machines. Acclaimed the most versatile machines for their size ever built, they're capable of performing a host of machining operations with efficiency and precision. And you get even greater production results from a combination of attachments and accessories — designed to increase the normal working range of the machine.

The 300-T machines (with 3-inch diameter spindle) are available with standard or built-in revolving tables with a wide variety of working ranges. Machines also feature rigid saddle supports . . . in-the-floor or over-the-floor type auxiliary runways . . . large bearing surfaces between the headstock and column which permit the machine to work at full capacity at the extreme limits of travel.

What's more, its 45 optional spindle speeds and 18 feeds in any speed range, augmented by a total of 23 milling feeds, exceed the requirements of modern shop practices and available tooling development. Find out how the 300-T outperforms any other horizontal built today.

Write for literature: **For complete specifications on Giddings & Lewis Models 300-T (table-type) and 300-RT (rotary table-type) machines, ask for Catalog No. 300-T.**

300T table type

Giddings & Lewis

horizontal boring, drilling and milling machines

Advanced design features plus an extensive line of optional equipment and accessories

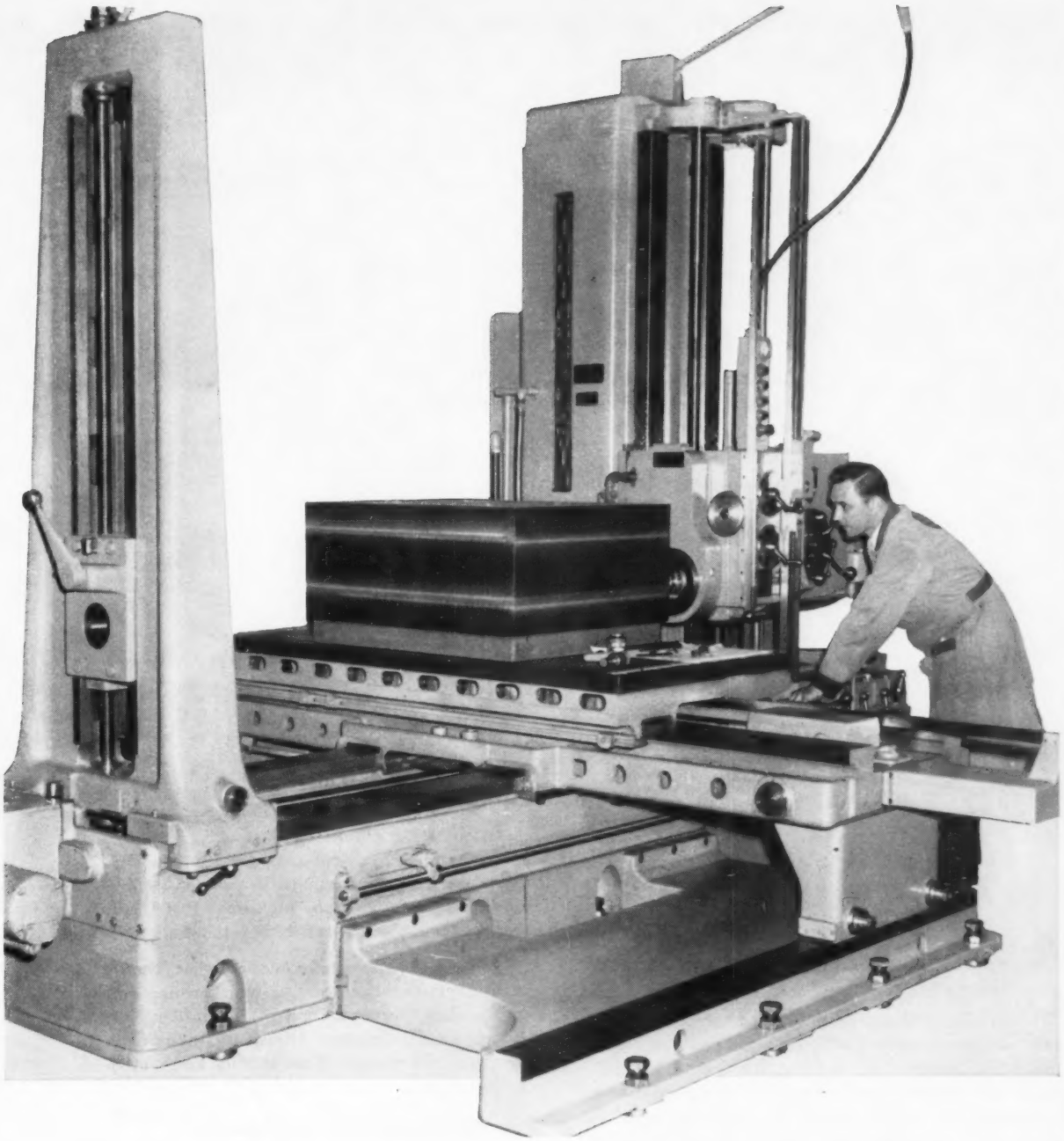
G&L *and* HYPRO DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

Fond du Lac, Wisconsin

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Vertical Turret Lathes; Spar and Skin Milling Machines, and VARIAX Machines.

G-59



EXTENDED SADDLES, SADDLE SUPPORTS and AUXILIARY RUNWAYS assure maximum rigidity and accuracy under heaviest loads . . . available with in-the-floor or over-the-floor auxiliary runways.

HEADSTOCK, TABLE, SADDLE operate independently in both directions of travel. Directional controls provide for easier operation of machine units. Heavy, box-type ribbing in column assures extra-rigidity for headstock.

SURFACE HARDENED WAYS on the bed and saddle prevent scoring and galling . . . assure longer-lasting accuracy.

COMPLETE SEPARATION OF CONTROLS plus color-coded, speed and feed dials simplify machine operation . . . considerably reduce floor-to-floor time.

PENDANT STATION with push-button controls permit machine operation at any point within operator's normal working range.

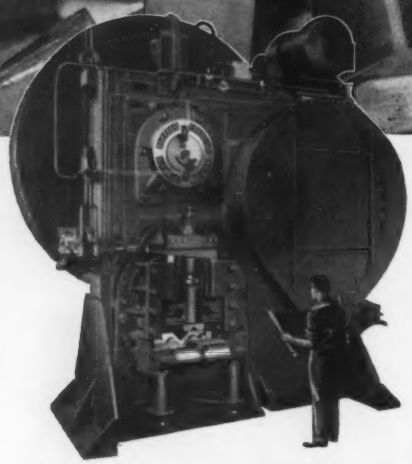
PRECISION MEASURING DEVICES are available for movement of headstock, table and saddle.

ANGULAR MILLING ATTACHMENTS permit many different milling, boring, reaming and similar operations.

CONTINUOUS FEED FACING HEAD simplifies unusual or complex work where surfaces to be machined are beyond normal range of machine.

AUTOMATIC ELECTRIC POSITIONING DEVICE accurately selects, maintains and controls distances between machined holes. Makes possible positive machine settings for boring operations repetitive to .0002"

For more information fill in page number on Inquiry Card, on page 219



No. 17 Billet Shear. Capacity, 10" rounds or 9" squares, 6 strokes per minute.

"Buffalo" Billet Shears are built in 11 sizes to handle *your* size rounds, squares or flats. The smallest one shears thirty 2¼" rounds per minute; the largest, six 10" rounds per minute. Rigid arc-welded steel plate frames —"power" lubrication—air operated clutches, counterbalance and hold-down—are some of the "Q" Factors* that assure you years of service with practically no maintenance.

a "Buffalo" billet shear did it all in 10 minutes!

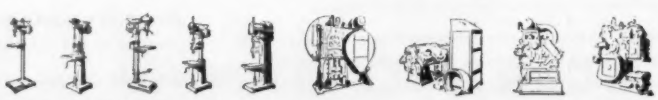
You're looking at a hundred 7" square billets readied for forging in just ten minutes by a "Buffalo" No. 15 Billet Shear with automatic feed table and back gage. This is just a sample of the high output of "Buffalo" Billet Shears in the nation's leading shops.

And note the clean, square faces of each cut. There's no smearing to conceal porosity, as with burning or sawing. The shear penetrates only 3/16", localizing a neat, accurate vertical fracture. Divisions are uniform in dimensions and weight. Your quality keeps up with your speed!

Write for Bulletin 3295-C for all details.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.



BUFFALO FORGE COMPANY

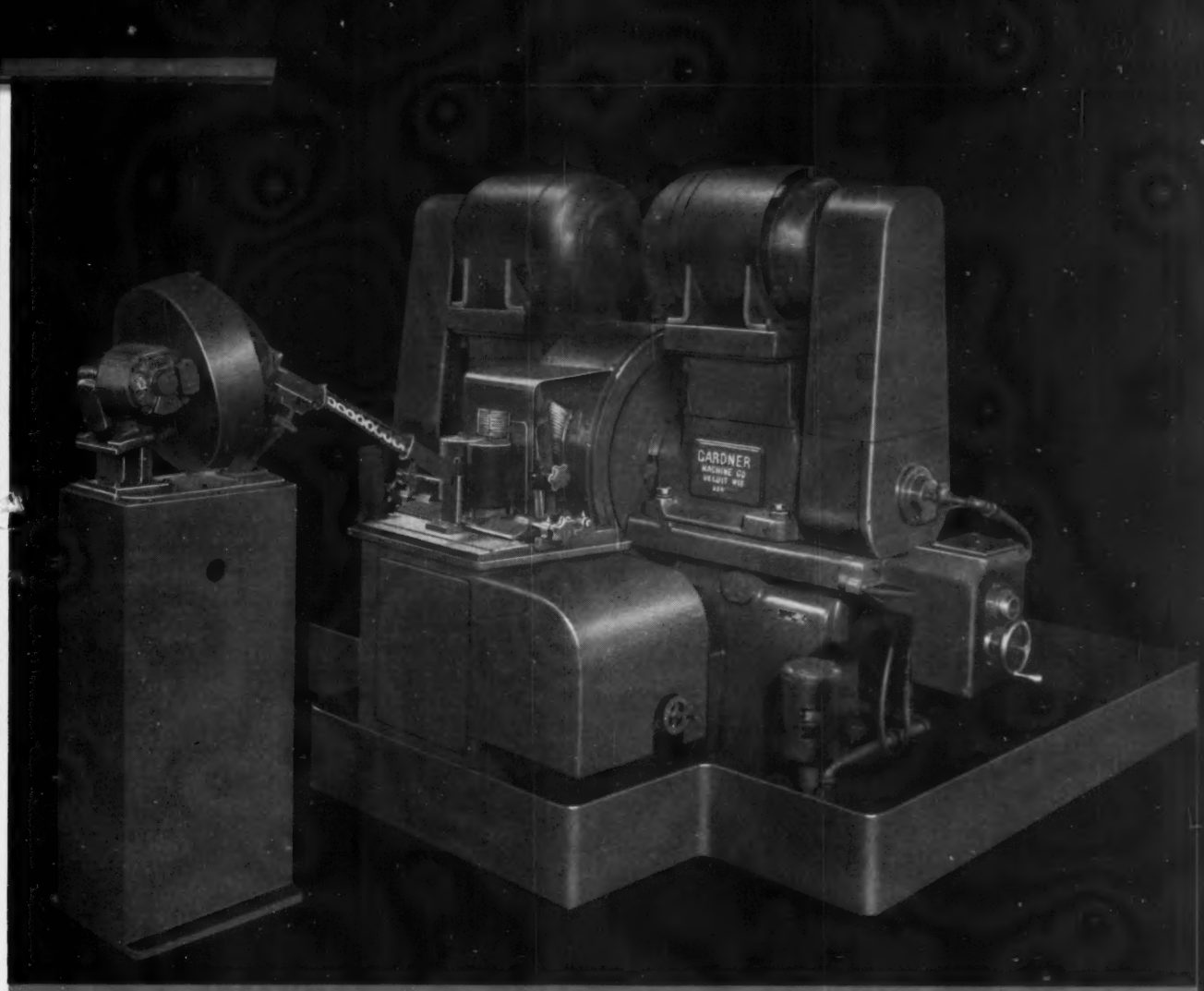
Machine Tool Division

440 BROADWAY BUFFALO, NEW YORK

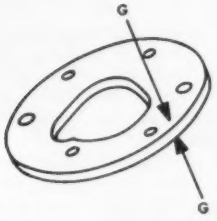
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

For more information fill in page number on Inquiry Card, on page 219



Grinds 9000 Surfaces per Hour



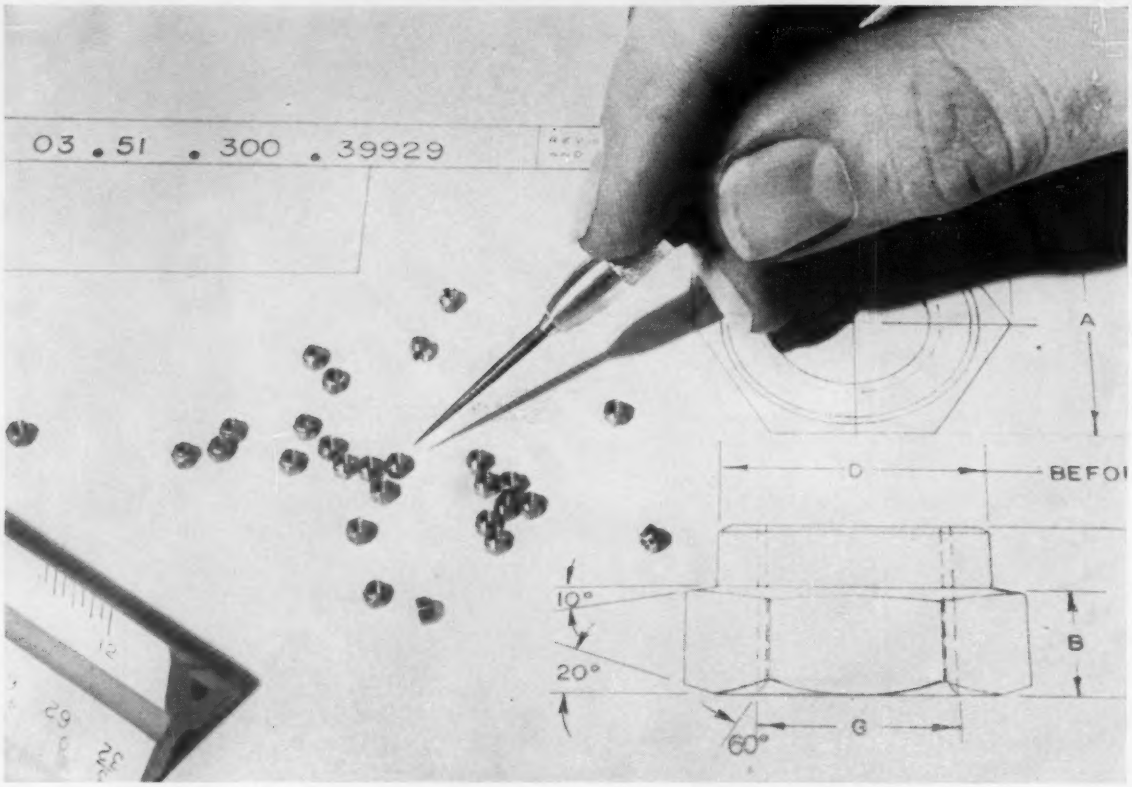
TWO parallel sides of thin plates ground in ONE operation

Job Data	
MACHINE	Gardner Precision Double Spindle Grinder.
TOOLING	Motor-driven hopper feeder and power-operated feed-thru rolls.
PART	Aluminum time fuse plate.
PRODUCTION	4500 per hour, both sides.
STOCK REMOVAL	.015" overall.
TOLERANCES	.0003" to .0005" for parallelism; .0015" for uniformity.
ABRASIVES	2 Gardner YELLOW-RIM WIRE-LOKT® Discs.

GARDNER

precision disc grinders

BELOIT, WISCONSIN



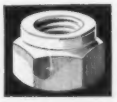
FLEXLOC MICROSIZE locknuts meet designers' needs for tiny precision nuts that retain strength and holding power in the smallest assemblies—servomechanisms, electronic and electrical equipment, all miniature devices.

Design Lighter, More Compact Products with New FLEXLOC Microsize Locknuts

Standard Microsize Locknuts Permit Design Engineers to Develop and Fasten Smaller Assemblies Safely

SIZE	Across Flats		Shoulder Height		Across Corners	Height +.000 −.003
	MAX.	MIN.	MAX.	MIN.	MIN.	
0-80 NF-3B	.111	.107	.047	.042	.123	.075
1-64 NC-3B	.127	.123	.0635	.0585	.141	.090
1-72 NF-3B	.127	.123	.0635	.0585	.141	.090
2-56 NC-3B	.158	.153	.068	.063	.176	.105
2-64 NF-3B	.158	.153	.068	.063	.176	.105
3-48 NC-3B	.190	.183	.071	.066	.210	.120
3-56 NF-3B	.190	.183	.071	.066	.210	.120
4-40 NC-3B	.190	.183	.072	.067	.210	.120
4-48 NF-3B	.190	.183	.072	.067	.210	.120

STANDARD MICROSIZE FLEXLOCs—in sizes ranging from 0-80 to 4-48—are available in brass (either plain or cadmium plated). Consult SPS for miniature nuts of other conventional materials.



New FLEXLOC Microsize locknuts are smaller and lighter than regular FLEXLOCs of the same nominal diameter. Wrenches of smaller size are used to install them. Mating joints or flanges can be designed smaller—with no loss in strength or convenience of assembly.

Microsize FLEXLOCs have all the advantages of larger FLEXLOCs. One-piece, all-metal construction—nothing to put together, come apart, lose or forget. Use them as lock or stop nuts—they stay put anywhere on a threaded member as soon as the locking threads are fully engaged. Uniform locking torques insure accurate preloading. There are no nonmetallic inserts to pop out or deteriorate. Moisture, dryness, oil, temperatures to 250°F won't affect these Microsize FLEXLOCs. Just screw them on. They lock and stay locked. Vibration won't shake them loose.

For complete information on Microsize FLEXLOCs, consult your authorized SPS distributor. Or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION SPS

JENKINTOWN PENNSYLVANIA

Feeling M-i-g-h-t-y Low?

IF GRINDING WHEEL PROBLEMS HAVE YOU DOWN IN THE DUMPS, DON'T MONKEY AROUND. Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

You'll start every day with a big smile and a spring in your step when CINCINNATI (PD) WHEELS are on the job. For through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

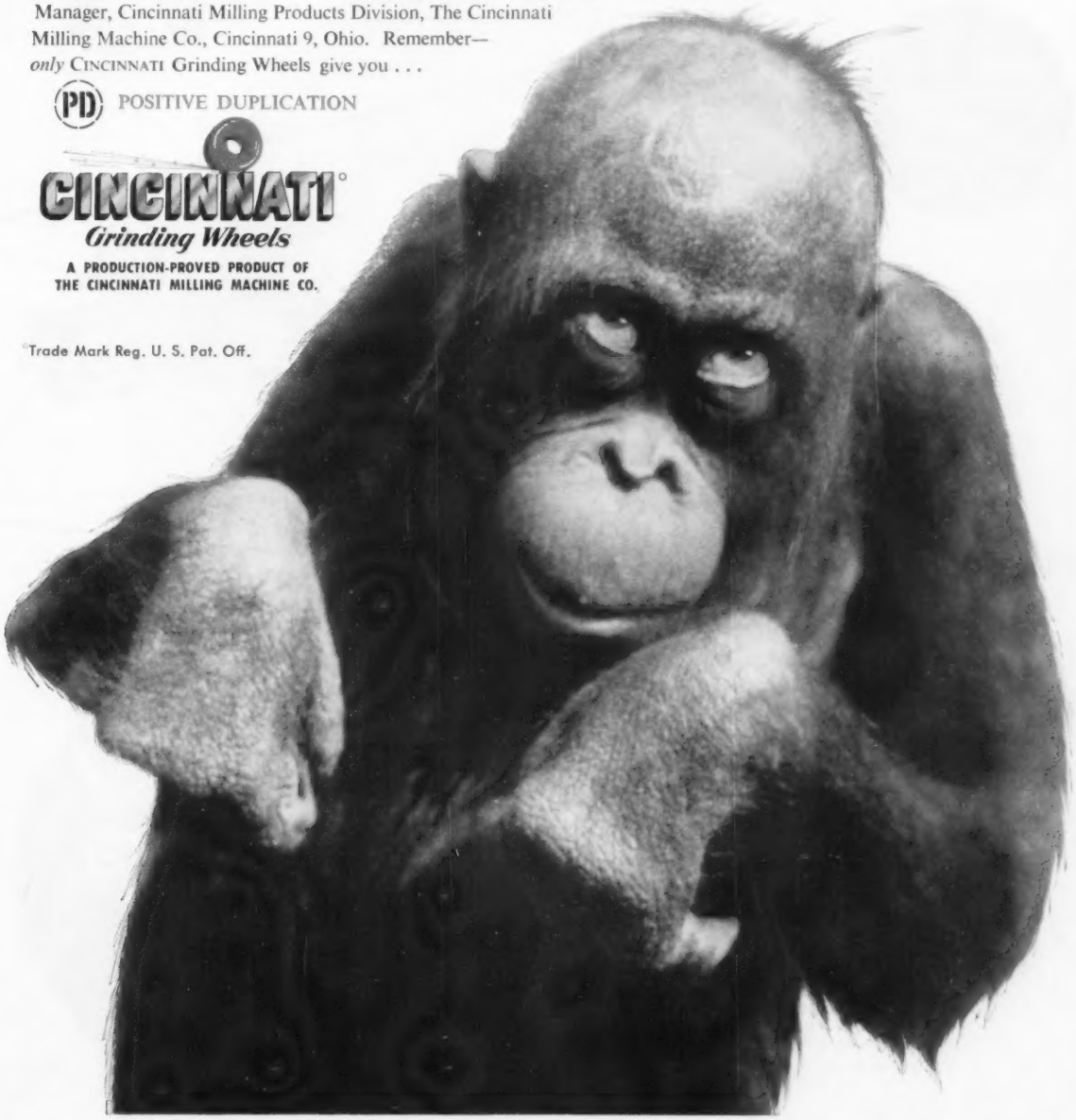
So, let us help you see the bright side of life once more. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

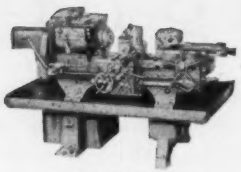
CINCINNATI° *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

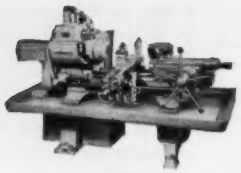
°Trade Mark Reg. U. S. Pat. Off.



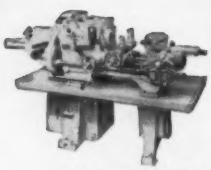
RAM TYPE TURRET LATHES



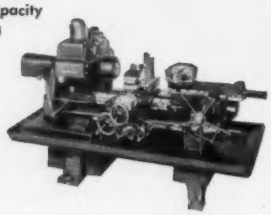
NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing



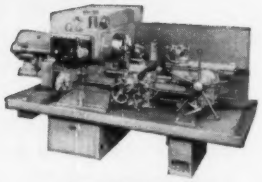
NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing



NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing



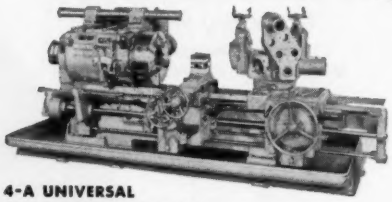
NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing



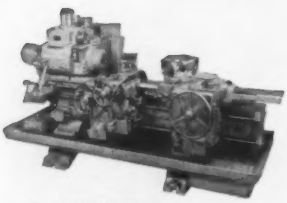
NO. 4 (M-2240)
2" Bar Capacity
18⅛" Swing

SADDLE TYPE TURRET LATHES
HEAVY DUTY

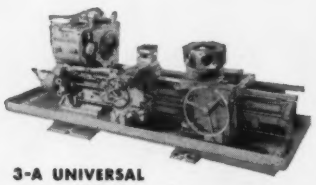
2-A UNIVERSAL
3½" Bar Capacity
20" Swing



4-A UNIVERSAL
8", 9" or 12" Bar Capacity
28¼" Swing

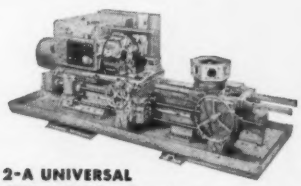


1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing

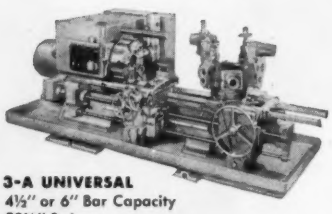


3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing

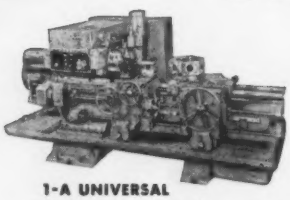
SADDLE TYPE TURRET LATHES
EXTRA HEAVY DUTY



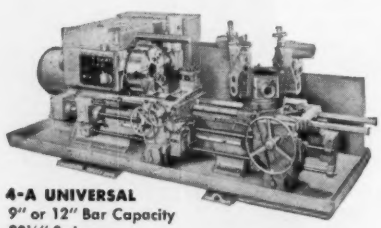
2-A UNIVERSAL
3½" or 4½" Bar Capacity
20" Swing



3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing



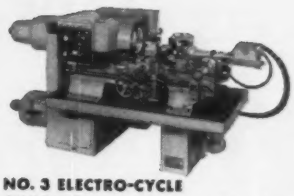
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing



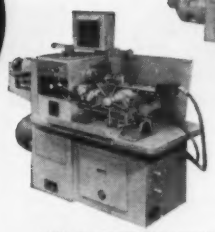
4-A UNIVERSAL
9" or 12" Bar Capacity
28¼" Swing

ELECTRO-CYCLE® TURRET LATHES

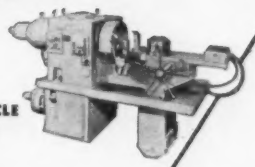
NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing



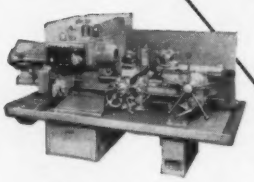
NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing



NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing



16" ELECTRO-CYCLE
1½" Bar Capacity
16⅞" Swing



NO. 5 (M-2250)
2½" Bar Capacity
20" Swing

The most complete line of Turret Lathes in the business!

18 DIFFERENT TURRET LATHES

... each individually designed, from the floor up, to most efficiently handle a specific group of work

® Reg. U. S. Pat. Off.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

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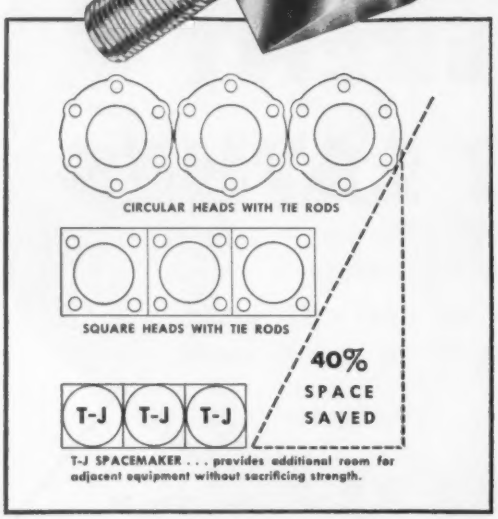
Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!



NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

- **NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion**
- **Compact design eliminates tie rods, saves up to 40% space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).**
- **OIL pressure to 750—AIR to 200 P.S.I.**

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J **TOMKINS-JOHNSON**

RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

For more information fill in page number on Inquiry Card, on page 219

How to IMPROVE your production BATTING AVERAGE

You'll lead the league when you switch to CIMCOOL°, the radically new and different cutting fluid. Here are three ways that CIMCOOL Standard Concentrate can improve your production batting average:

- **CIMCOOL LOWERS COST** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL IMPROVES TOOL LIFE** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil clothing or hands. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

For full details on CIMCOOL Standard Concentrate—and on the entire family of CIMCOOL Cutting Fluids—just contact us. Wire, write or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

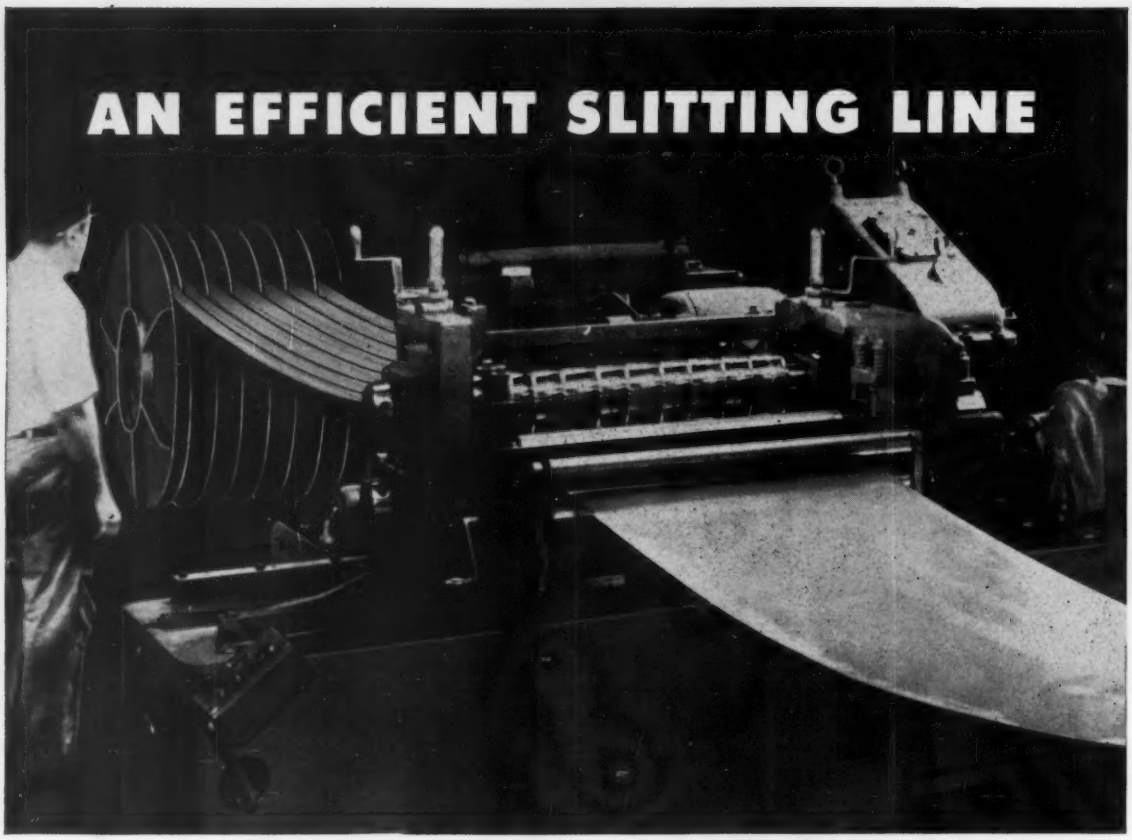
CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

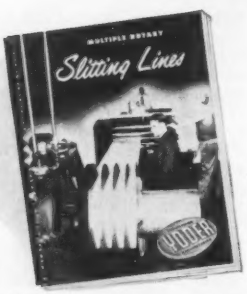
for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

AN EFFICIENT SLITTING LINE



...with big savings possibilities



The Yoder Slitter Book contains time studies, production records, and other valuable data on the economics as well as mechanics of slitter operation. A copy is yours for the asking; also estimates and recommendations.

The standardized series of Yoder Uncoilers, Slitters and Recoilers make possible an infinite number of combinations for highly efficient coil and sheet slitting.

At a substantial saving in first cost, one of these combinations will meet widely varying production needs of fabricating shops as efficiently as higher priced, built-to-order equipment (also designed and built by Yoder) for very big tonnage requirements.

A Yoder standardized slitting line is a most profitable production tool which will pay for itself in short order on strip requirements as low as 100 tons per month, even less. Equally important is the ability in a few hours to meet expected and unexpected needs for slit strands, from a relatively small stock of standard width coils. This greatly reduces strip inventories and simplifies production planning.

THE YODER COMPANY • 5504 Walworth Avenue, Cleveland 2, Ohio

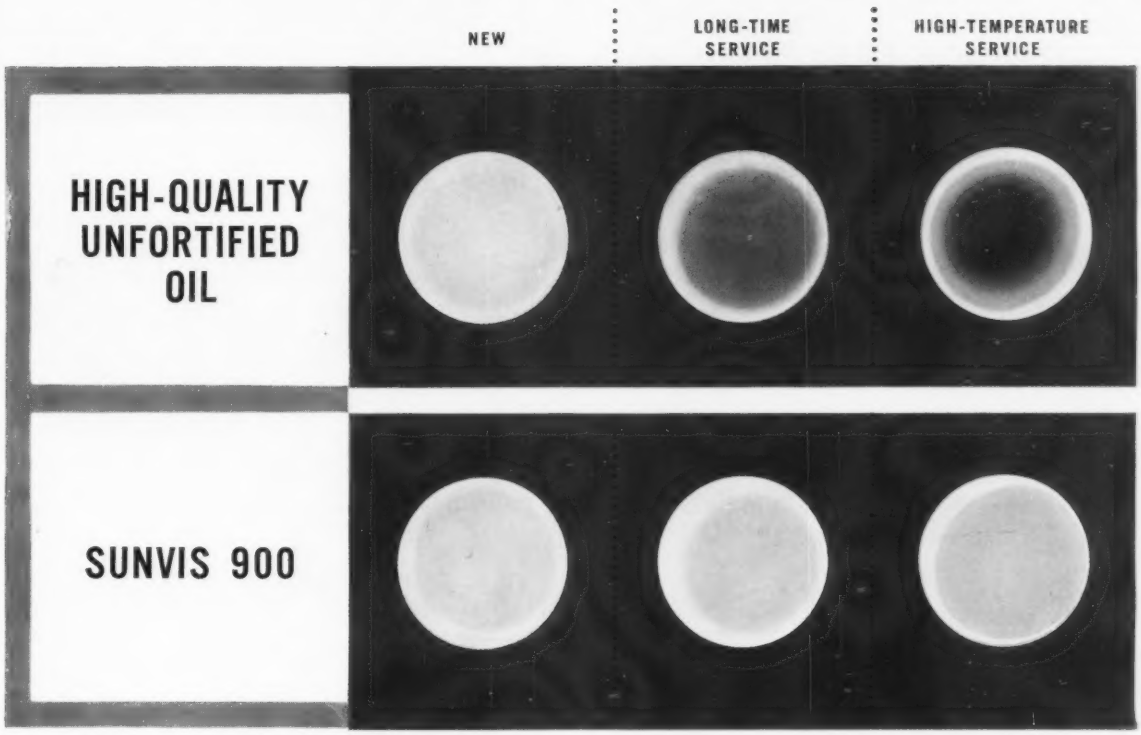
ENGINEERING YODER MANUFACTURING

ROTARY SLITTING LINES

COLD ROLL FORMING MACHINES

ELECTRIC-WELD PIPE AND TUBE MILLS

For more information fill in page number on Inquiry Card, on page 219



Oil color tests show

WHY SUNVIS 900 OILS SAVE YOU MONEY IN CIRCULATING AND HYDRAULIC SYSTEMS

Color means very little in brand new oils. But...color *change* during service can mean a lot. While minor darkening is seldom serious, radical color changes indicate danger, except, perhaps, in a highly detergent oil.

Either the oil is contaminated by foreign matter, or as in the pictures, the oil has oxidized from heat and long use. The products of oxidation darken the color of ordinary oils...clog valves and filters, cause excessive maintenance.

Compare the appearance of the used Sunvis 900 with the appearance of the other used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

Here's proof that Sunvis 900 oils will last longer and provide the extra needed resistance against the high temperature "hot-spots" of typical hydraulic and circulating systems. *For the long run, a Sunvis 900 oil is the most economical oil you can buy.*

For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-31.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

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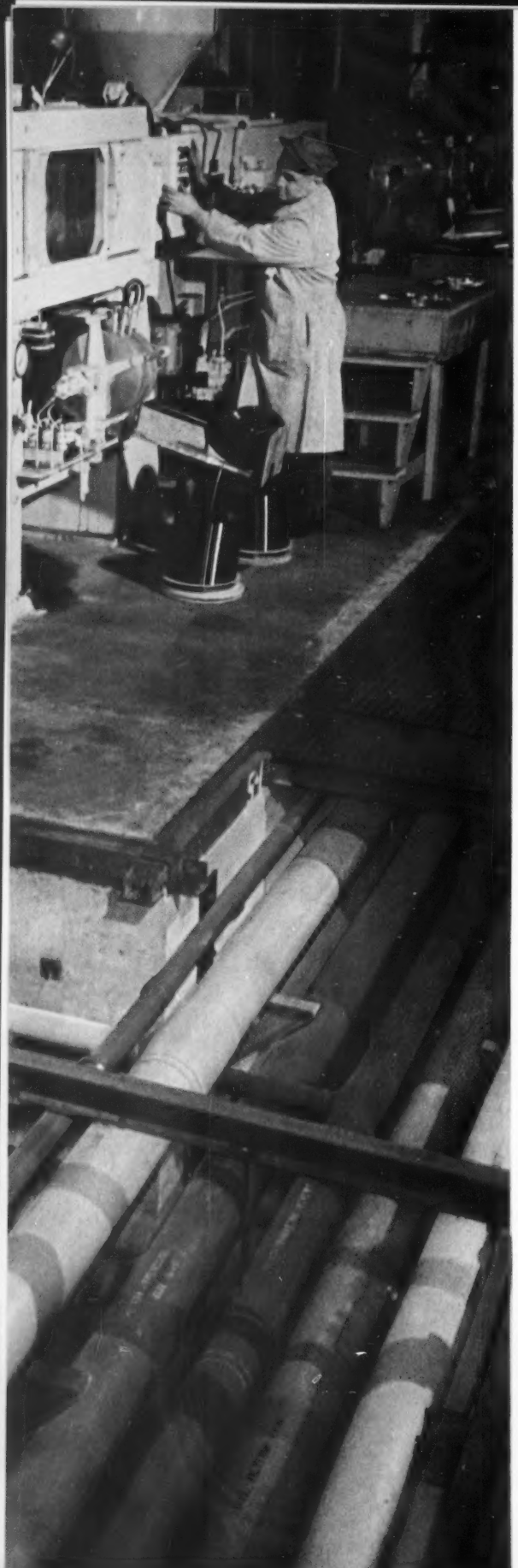
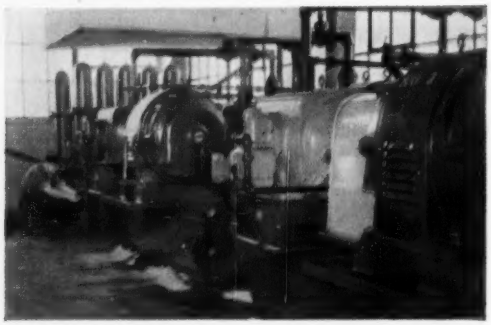
In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO



High-Pressure Pumps, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

This is just part of the story about Sunvis 900 oils. Why not talk them over with your Sun representative the next time he calls. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-32.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

© SUN OIL CO.

Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal

Vinson Steel and Aluminum Co.
Dallas, Texas says:

Shearing capacity of this machine is 12'-0" x ½" mild steel. Note accessibility of two cranks on right end housing. Upper crank is for knife adjustment. Lower one is for back gauge adjustment.

Adjustable Blade Clearance Allows Use of Shear for Complete Range of Thicknesses

THE feature that Vinson Steel and Aluminum Company likes best on their Steelweld Shear is the adjustable blade clearance. This permits them to use the one machine for their complete range of thicknesses. They go as low as 26 gauge galvanized material and up to ½ inch mild steel and ½ inch aluminum.

As a leading supplier of metal in North and West Texas, Vinson insists on cuts being sharp, straight and accurate. This requires that the blade clearance be correct for every thickness cut. Because of the unique easy method of adjusting the clearance on Steelweld Shears, the adjustment can be made in seconds.

Another item which is impressive is the low maintenance cost. This machine has been in service for over two years, and the maintenance has been practically nil.

More and more warehouses are installing Steelweld Shears. Usually one will handle a range of work that would require two or more other type machines not built with a fast knife adjustment feature.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
5452 East 282 Street
Wickliffe, Ohio

STEELWELD
BENDING PRESSES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

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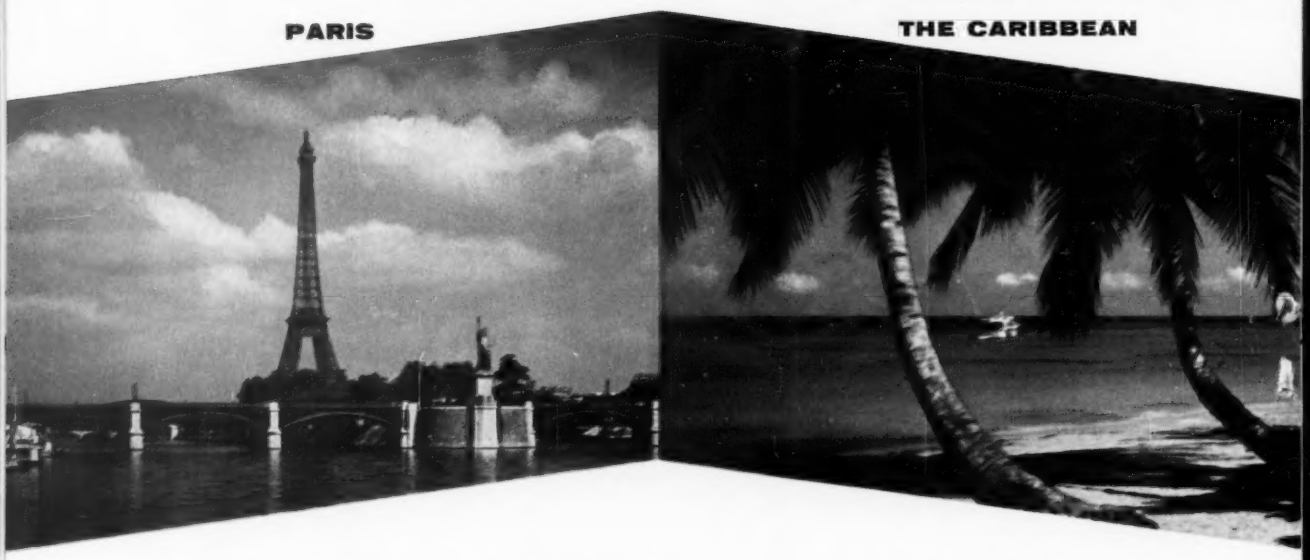
WIN a 2-weeks LUXURY

All Expenses Paid,



ENTER JONES & LAMSON'S

NEW HORIZONS

Grand Prize:

Two-Weeks Luxury Vacation Trip for Two, All Expenses Paid, to a choice of one of the following: Paris, Hawaii, The Caribbean, The Canadian Rockies, Plus $400 for spending money, baby sitter fee, etc.

Two 2nd Prizes: Each a Seven-Day All-Expenses-Paid Luxury Vacation for Two to Bermuda. Plus $200 spending money.

Three 3rd Prizes: Each a Shopmaster Combination Saw-Jointer Power Tool, complete with motor.

Ten 4th Prizes: Each a Shopmaster Individual Single-Purpose Power Tool (A Choice of Saw, Drill Press, Jointer, etc.)

Jones & Lamson, famed for opening up NEW HORIZONS in metalworking efficiency, now offers you, personally, NEW HORIZONS — a luxury vacation for two people for two weeks with all expenses paid, to your choice of Paris, Hawaii, The Caribbean or The Canadian Rockies.

Think of it — you can enjoy deluxe travel, finest hotels and accommodations, the very best of everything, plus $400 spending money. Live like a millionaire for two weeks, for just answering this question, "Which Jones & Lamson machine, or machine feature, could, or does, help you most, and Why?"

When you write in (use coupon or not, as you wish), we will send you an official entry form, together with information upon which to base your answer. So don't delay! Even if you've never entered any contest before . . . if you have a good idea and can express it clearly — *YOU* may win this glorious luxury vacation for two! And don't forget — there are other prizes! — two deluxe 7-day all-expenses-paid vacations for two to Bermuda, and 13 prizes of famous Shopmaster home workshop Power Tools! Enter *today!* Read the simple rules, and send in this coupon *NOW!*

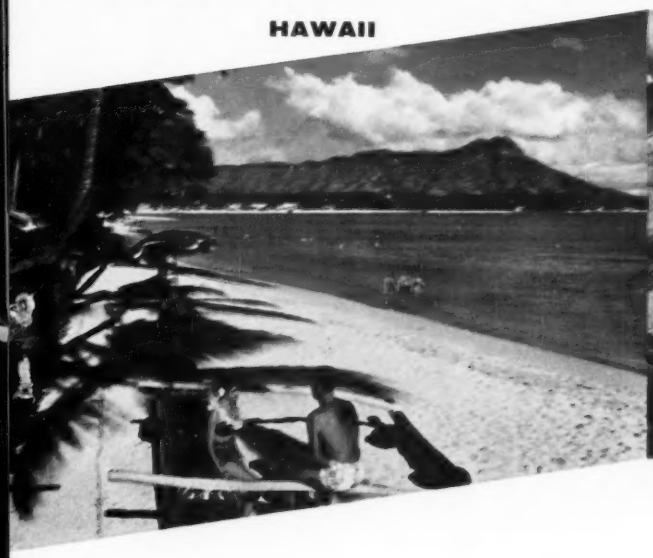
J&L JONES & LAMSON MACHINE COMPANY

512 CLINTON STREET, SPRINGFIELD, VERMONT

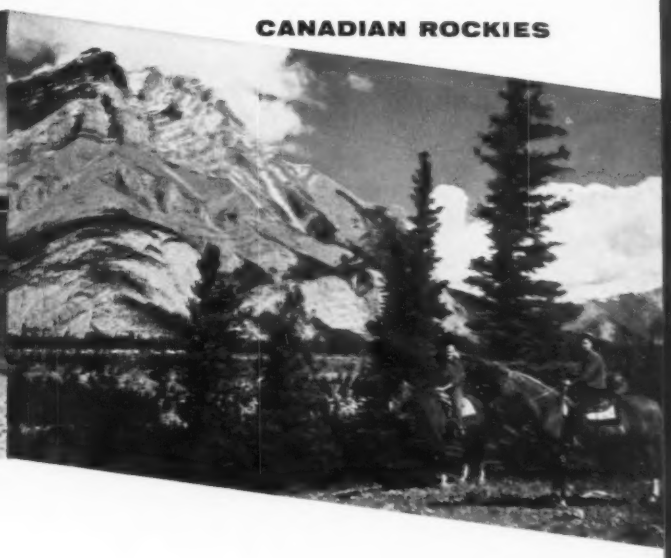
VACATION FOR TWO!

to your choice of . . .

HAWAII



CANADIAN ROCKIES



CONTEST TODAY!

CONTEST RULES

Contest is open to all persons, residing in the continental U. S. A., engaged in metalworking or allied industries, except employees of Jones & Lamson Machine Company, its selling agents and its advertising agency, and members of their families.

Contestants merely answer, in 150 words or less, the question "Which Jones & Lamson Machine, or Machine Feature, could, or does, help you most, and Why?"

Entries are to be mailed to Jones & Lamson NEW HORIZONS CONTEST, Box 364, Back Bay Annex, Boston 17, Massachusetts.

Entry must be contestant's own, and must be handprinted or typed on an official Jones & Lamson NEW HORIZONS CONTEST entry form. Entry forms that are not completely filled out will be disqualified. Entry forms filled out in handwriting will also be disqualified. No entries will be returned, and all entries become the property of Jones & Lamson Machine Company.

The submitting of a contest entry implies the contestant's agreement with and submission to all contest rules. Contest entries must be postmarked by midnight July 10, 1956 and received by July 20, 1956.

Board of Judges will include machine tool engineers, production foremen, business executives, trade publication editors, and an engineering college faculty member.

Judges' decisions are final. Entries will be judged for aptness of thought, originality and sincerity. "Literary style", as such, will *not* be a deciding factor. Elaborate or "fancy" entries will receive no extra consideration.

Winners will be announced in Jones & Lamson Machine Company advertisements in trade publications as soon as possible after the judging of the contest.

Easy to Enter! You Could Win!

JONES & LAMSON MACHINE COMPANY
512 Clinton Street, Springfield, Vermont

Please send official NEW HORIZONS CONTEST entry form and information to:

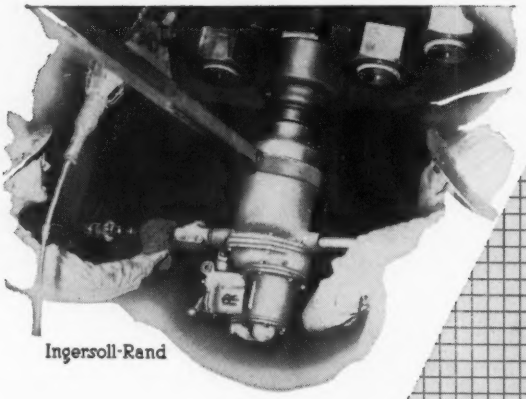
*Name*_____

*Address*_____

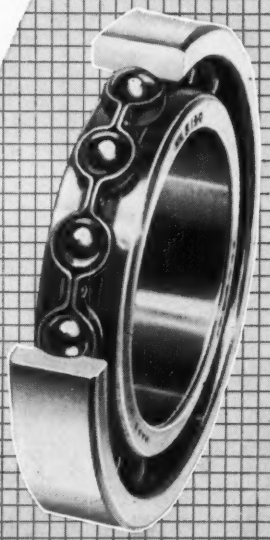
*City*_____ *Zone*____ *State*_____

Nuts and Bolts...

Tightening and removing 5" diameter nuts and 3¼" diameter bolts on a 115,000 HP Hydro-Generator! A rugged task, but this rugged Air Impactool is equal to it! And, like so many hard-working tools, it uses hard-working anti-friction bearings. Federal Ball Bearings, of course!



Ingersoll-Rand



so much of industry *turns* on FEDERAL ball bearings

On tough jobs or rough roads...in the machine shop, office or on the farm. Wherever anti-friction problems need to be solved—that's where you'll find Federal Ball Bearings at work. There are hundreds of types—12,000 sizes—and they're produced by a 50-year-old manufacturer of ball bearings *exclusively!*

When Federal Ball Bearings are part of so many things you *use*, shouldn't they be part of the things you *make*?

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, N. Y.

Latest ball bearing and engineering data! Full 175 pages of it—in FEDERAL'S *NEW* CATALOG! Just speed us your request and we'll speed you back your copy!

or Ruts and Jolts...

Our old friend the Jeep—new CJ model. As ever; daring, dependable, durable—on the road or off! It, too, is served by reliable Federal Ball Bearings—doing their anti-friction job in the gear transmission.

WILLYS

Federal BALL BEARINGS

One of America's Largest Ball Bearing Manufacturers

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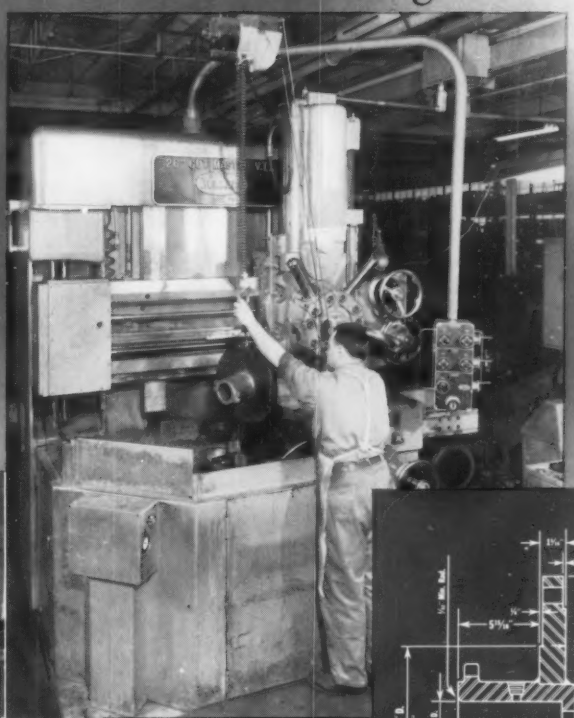
NEW BULLARD

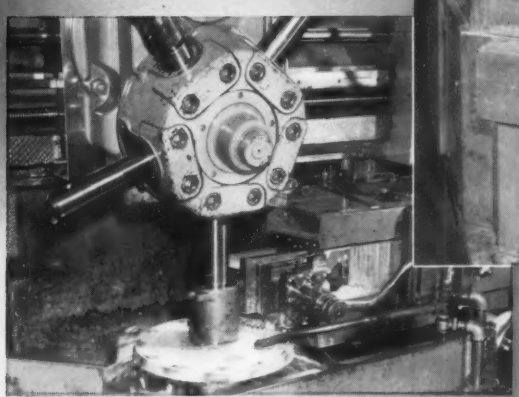
CUT MASTER V.T.L.

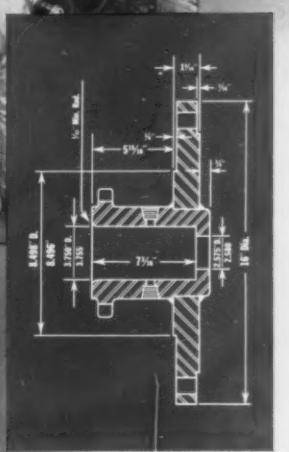
MODEL 75

25% reduction in machining time

Manufacturers of fluid mixing equipment for numerous applications in industry, Mixing Equipment Co., Inc., Rochester, New York, are enthusiastic in their acclaim of the performance of their new 26″ Cut Master, Model 75.







Easier loading and chucking, greater capacity and accuracy, combined with ease of operation are the factors contributing to the increase in production according to Mr. Walter Schmidt, General Foreman.

Are you interested in applying these advantages to your manufacturing processes? If so, call your nearest Bullard Representative or mail coupon to

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT
Please send me a copy of the
NEW CUT MASTER V.T.L., MODEL 75 CATALOG

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COMPANY _____ POSITION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

HELIARC Cutting

TRADE-MARK

CUTS ALUMINUM AT SPEEDS UP TO 300 INCHES PER MINUTE

HELIARC cutting, a new process developed by LINDE, brings all the desired features of economical high-speed operations to the cutting of aluminum.

★ **Speeds never before possible:** Normal mechanized cutting speeds are 300 in. per min. in ¼-in. material, 125 in. per min. in ½-in. material, 75 in. per min. in ¾-in. material, and 50 in. per min. in 1-in. plate. If desired, lower speeds can be obtained by simply adjusting the controls.

★ **Straight lines, bevels, contours—no problem:** The new HELIARC cutting process can be used mechanically or manually. Both setups produce high-quality straight line cuts, bevels, circles, and shapes with revolutionary new speed and efficiency.

HELIARC cutting employs a high-temperature, high-velocity, constricted arc between a tungsten electrode and the piece to be cut. The concentrated, columnated energy of the arc stream melts and ejects a thin section of metal to form a kerf. The gas atmosphere (a combination of argon and hydrogen) prevents oxidation of the cut face.

Learn the details of how HELIARC cutting can help you increase production and cut operating costs. Call your LINDE Representative today.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

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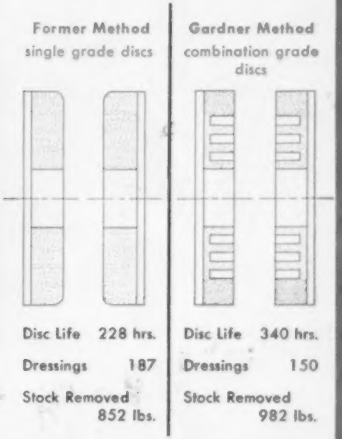
Disc life increased by 50%

Combination grade Gardner discs cut down time remove more metal per disc

Double disc grinding of small coil springs caused "bell-mouthing" of discs, low production, excessive dressing . . . . Gardner Abrasive Specialist recommended combination grade disc with smooth outer face of harder grade and deep corrugated inner surface of softer grade. The harder outside section resists wear, results in greater stock removal, longer life, fewer dressings.



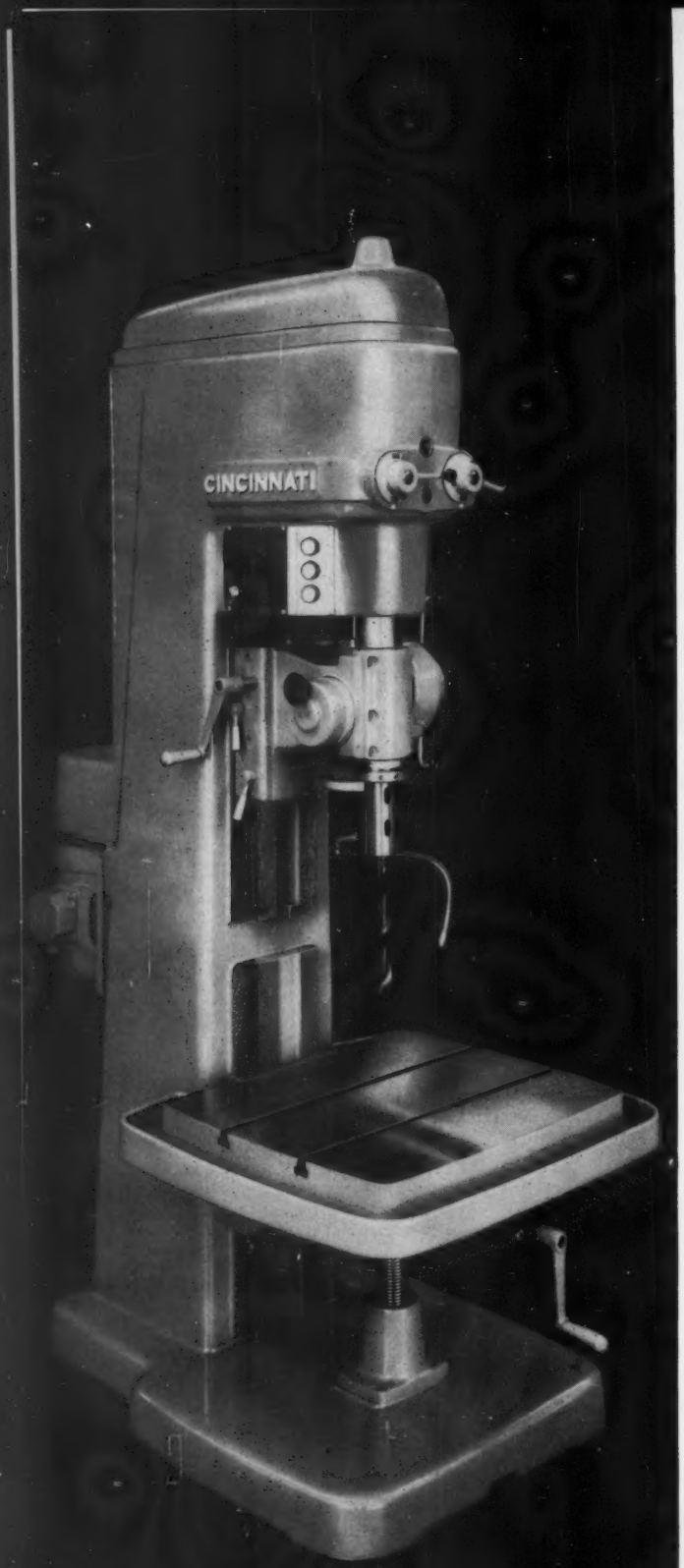
Softer grade with deep corrugations for rapid chip clearance

Harder Grade Smooth section for shear cut and uniform wear

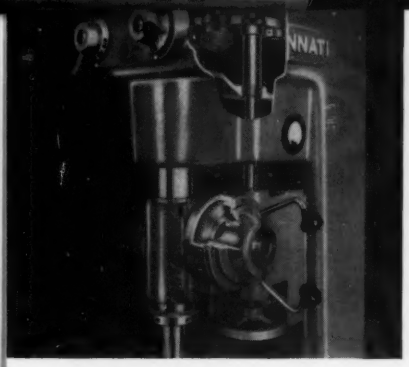
GARDNER

abrasive discs

BELOIT, WISCONSIN

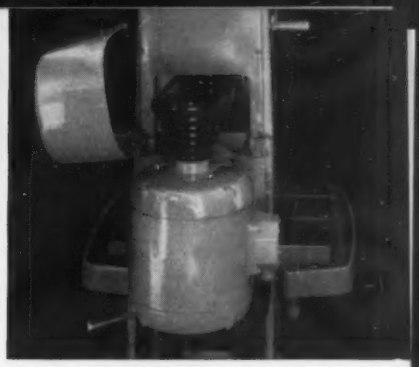


NEW CINCINNATI 21" SLIDING-HEAD PRODUCTION DRILLS PERFORM AS GOOD AS THEY LOOK



NEW GEARED POWER FEED—The feed clutch levers engage a powerful, positive jaw clutch. Four feeds are provided—.004", .007", .010", and .015" per spindle revolution.

NEW DEPTH DIAL—This big, direct-reading dial is calibrated in 16ths of an inch. It has a positive stop for hand feed and power feed, and will disengage power feed automatically on identical operations.

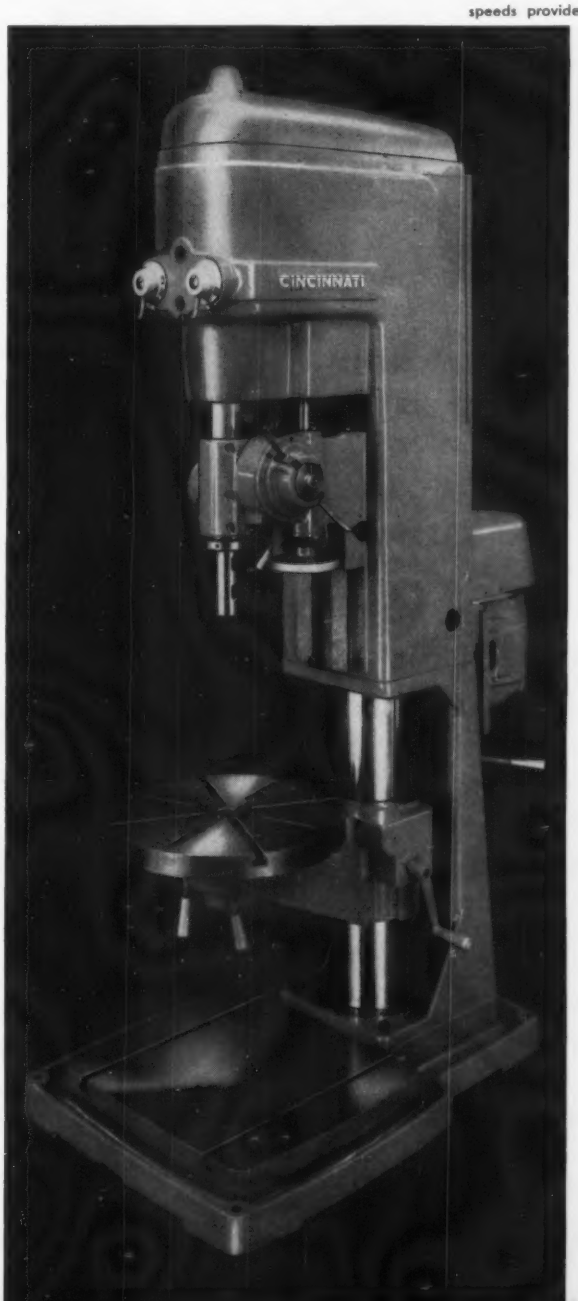


NEW EASY SPEED CHANGE—Any of 12 spindle speeds is obtained easily and quickly. Each belt position provides two speeds, low and high. To set for desired speeds, merely raise the motor cover, tilt the motor bracket with the lever provided, and reposition the V-belt on both sheaves. Then use the convenient "Hi-Lo" selector for either of the speeds provided by the belt position you choose.

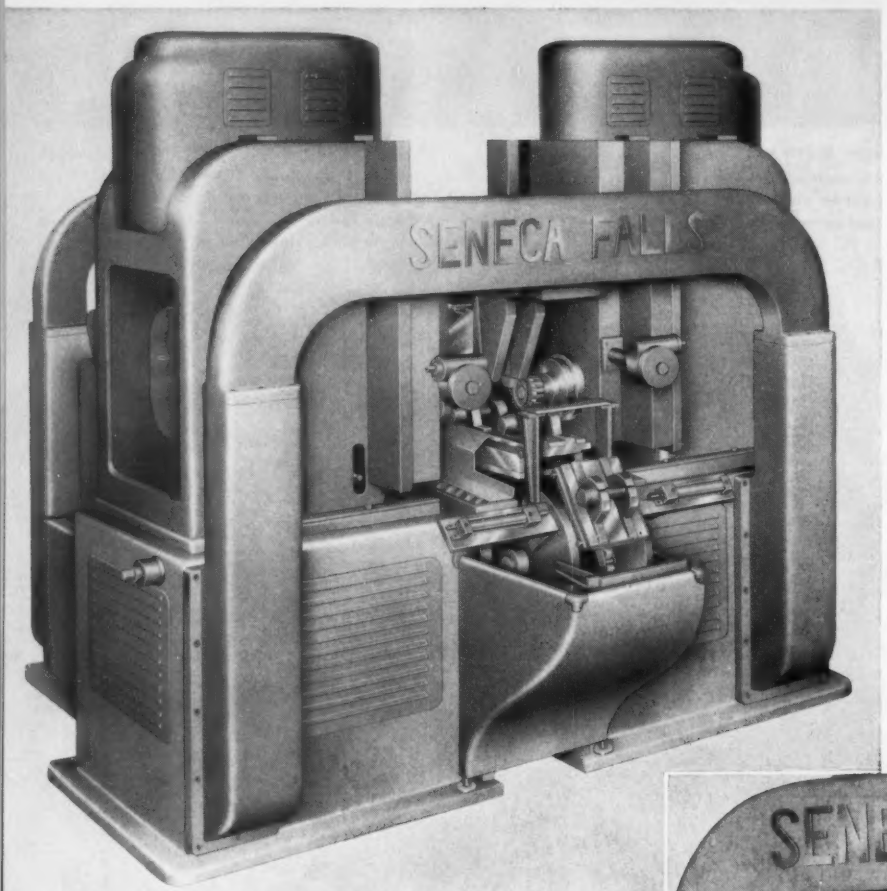
Available in Round or Box Column — Multiple or Single Spindle

Here's a drill to meet all your production needs up to 1½" capacity in cast iron. Available in both round and box column models, and in multiple spindle arrangements up to 6 heads, this new drill performs as good as it looks. Start, stop, and reverse buttons and coolant selector switch (if ordered) are easy to reach and completely built in. A transformer is supplied on all machines operating on 220 volts or over to reduce voltage to 110 volts at the push-button station for operator safety. Any of twelve spindle speeds is obtained easily and quickly.

Write for complete catalog information and the name of your local CL&T Dealer. Cincinnati Lathe and Tool Company, 3268 Disney Ave., Cincinnati 9, Ohio.



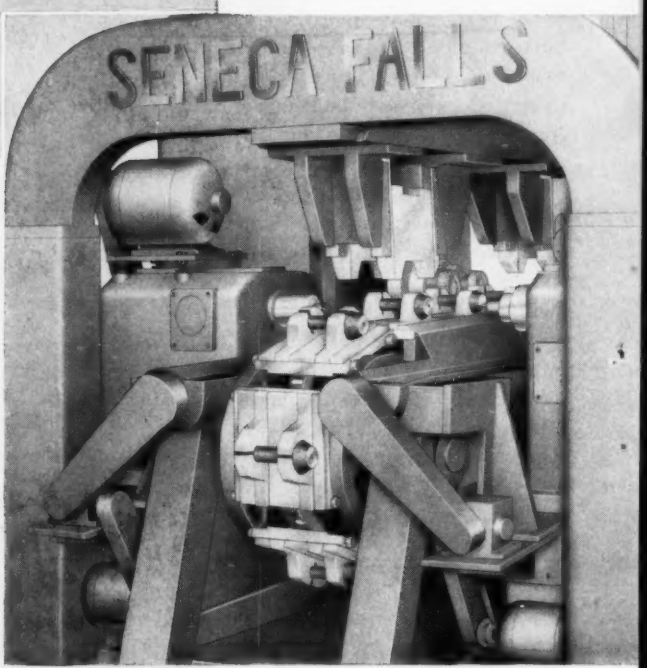
MACHINE OF



Write Seneca Falls Machine Co., Seneca Falls, N. Y. for Bulletin MX-B

◀ *Front view of Model MX Milling and Centering Machine showing milling stations. Loading and unloading of work pieces is done at this end of the machine, although an unloading station can be provided at rear of the machine if desired.*

Rear view of machine showing centering station. Work carriers, attached to an endless chain, carry finished pieces horizontally thru the machine tunnel to the front loading and unloading station. ▼



MODEL MX DESIGN FEATURES

- ▶ High production, multiple station, fully automatic machine.
- ▶ Standardized tool carrying heads.
- ▶ Ease of tool and cutter changing.
- ▶ Automatic in-line work transfer from station to station.
- ▶ Automatic cycle interruption in case of overload on tools.
- ▶ Automatic rapid traverse movement for all tool heads.
- ▶ Ease of loading and unloading.
- ▶ Automatic power clamping devices.
- ▶ Hardened and ground ways for work carriers.
- ▶ Motorized chip disposal.
- ▶ Simplified maintenance.
- ▶ Manual push-button operation.

PROFIT ENGINEERED

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE So-swing PEOPLE" SENECA FALLS, NEW YORK

NEW...SENECA FALLS AUTOMATIC TRANSFER TYPE, MILLING AND CENTERING MACHINE

● The new Seneca Falls Model MX Double End, Transfer Type, Automatic Milling and Centering Machine is designed to insure accuracy and reduce manufacturing costs on milling to length and centering operations by combining these operations on a single machine serviced by one operator.

The machine is of the horizontal, indexing transfer type with mechanical feeds and positive drive devices. Strength and rigidity characterize the massive base and columns which support the milling heads. The box type columns absorb vibration from heavy cutting loads imposed by carbide milling cutters operating at high cutting speeds and coarse feeds.

Double end, multiple work head design and construction maintains definite relations between milled ends and centers of the work pieces which are securely clamped on individual platens during the entire machining operation.

The machine illustrated is equipped for rough and finish milling operations as well as for the centering operations. However, design is such that single, face milling heads may be supplied in combination with other type heads for end milling driving slots in the face of the work pieces or for combined drilling, reaming, boring, threading and tapping operations in one or both ends of work pieces.

The Work Holding and Work Transfer Mechanism operates on the endless chain principle and the work carriers are indexed from one cutter head to another as the work pieces progress from the loading station to the rough milling, finish milling and center drilling stations. All work carriers are stationary during actual machining operations.

SENECA FALLS MACHINE CO., SENECA FALLS, N.Y.

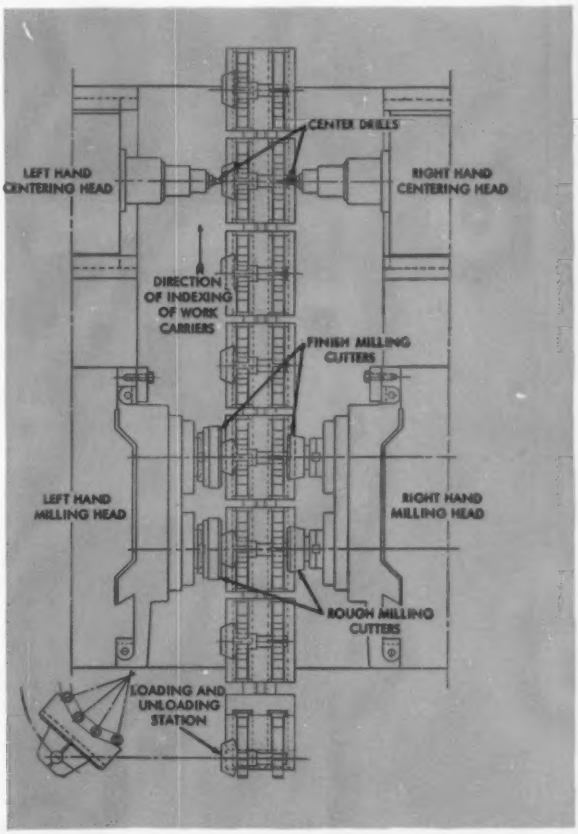
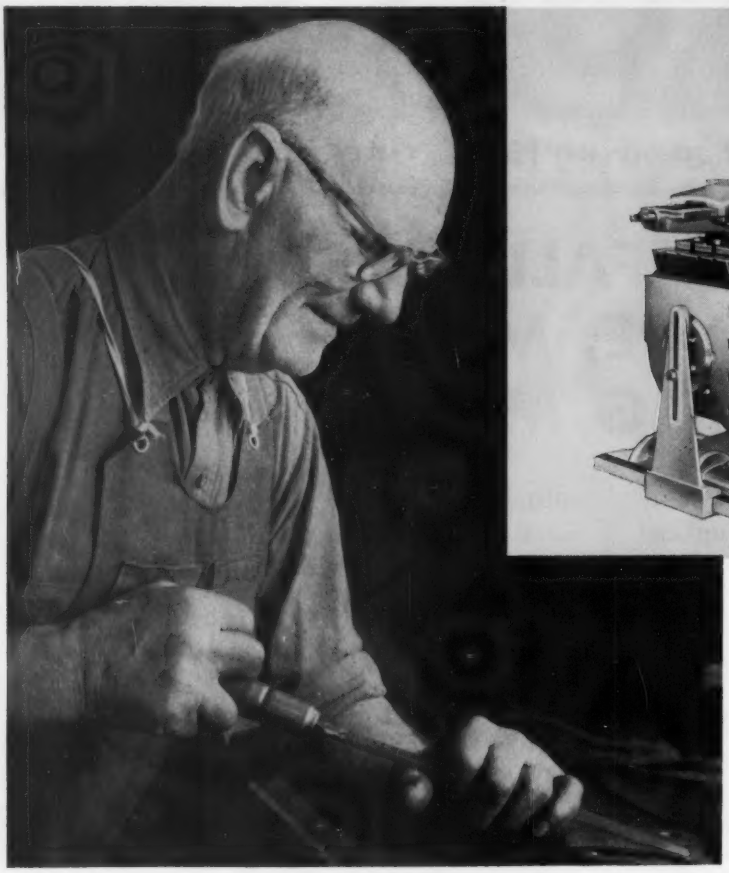
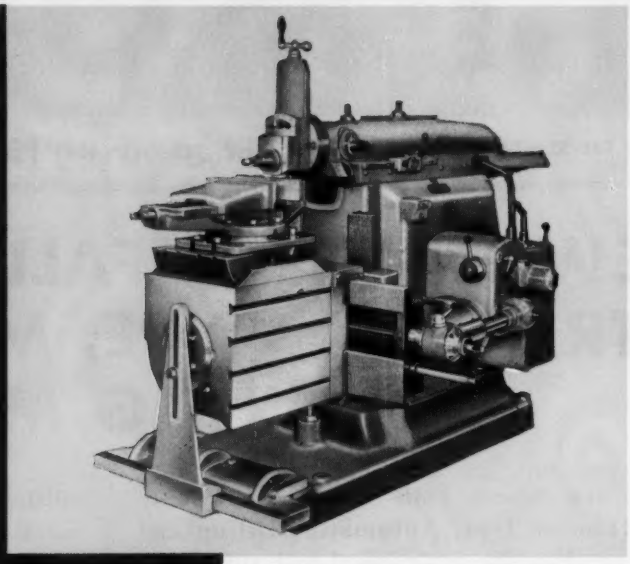


Diagram of flow of work pieces thru Seneca Falls Model MX Automatic Milling and Centering Machine.

BY SENECA FALLS





VMA Universal Shaper Model ES-26

UTOMORDENTLIG YRKESSKICKLIGHET

(SUPERB CRAFTSMANSHIP)

VMA SHAPERS - built by Sweden's master craftsmen - are engineered to maintain precise tolerances in continuous heavy-duty production. Built to U. S. standards, VMA Shapers—both heavy duty and standard models — meet all requirements for modern versatile machines.

VMA Model ES Heavy Duty Shapers, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
- Double helical crank gear
- Chrome nickel steel transmission
- Anti-friction bearings throughout
- Dependable safety clutch

VMA Model EV Series . . . economical standard-duty Shapers with stroke lengths from 14" to 24".

- Highly accurate and dependable, Model EV Shapers are ideal for job shop or tool room use not requiring the extra power of the ES Series. Easy to operate — economical to own.

austin

INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

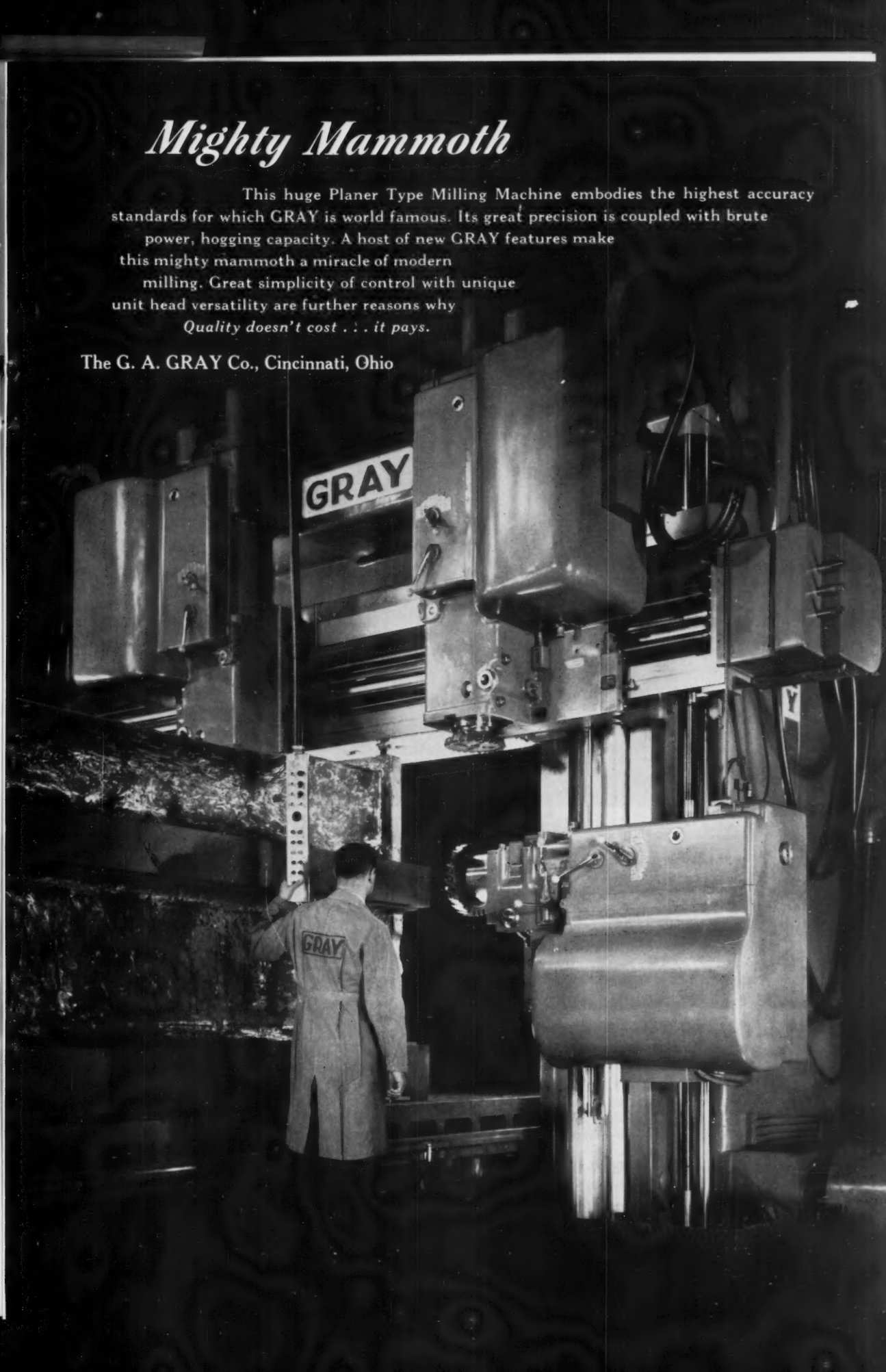
For more information fill in page number on Inquiry Card, on page 219

Mighty Mammoth

This huge Planer Type Milling Machine embodies the highest accuracy standards for which GRAY is world famous. Its great precision is coupled with brute power, hogging capacity. A host of new GRAY features make this mighty mammoth a miracle of modern milling. Great simplicity of control with unique unit head versatility are further reasons why

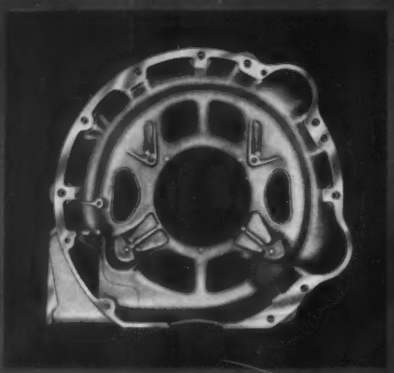
Quality doesn't cost . . . it pays.

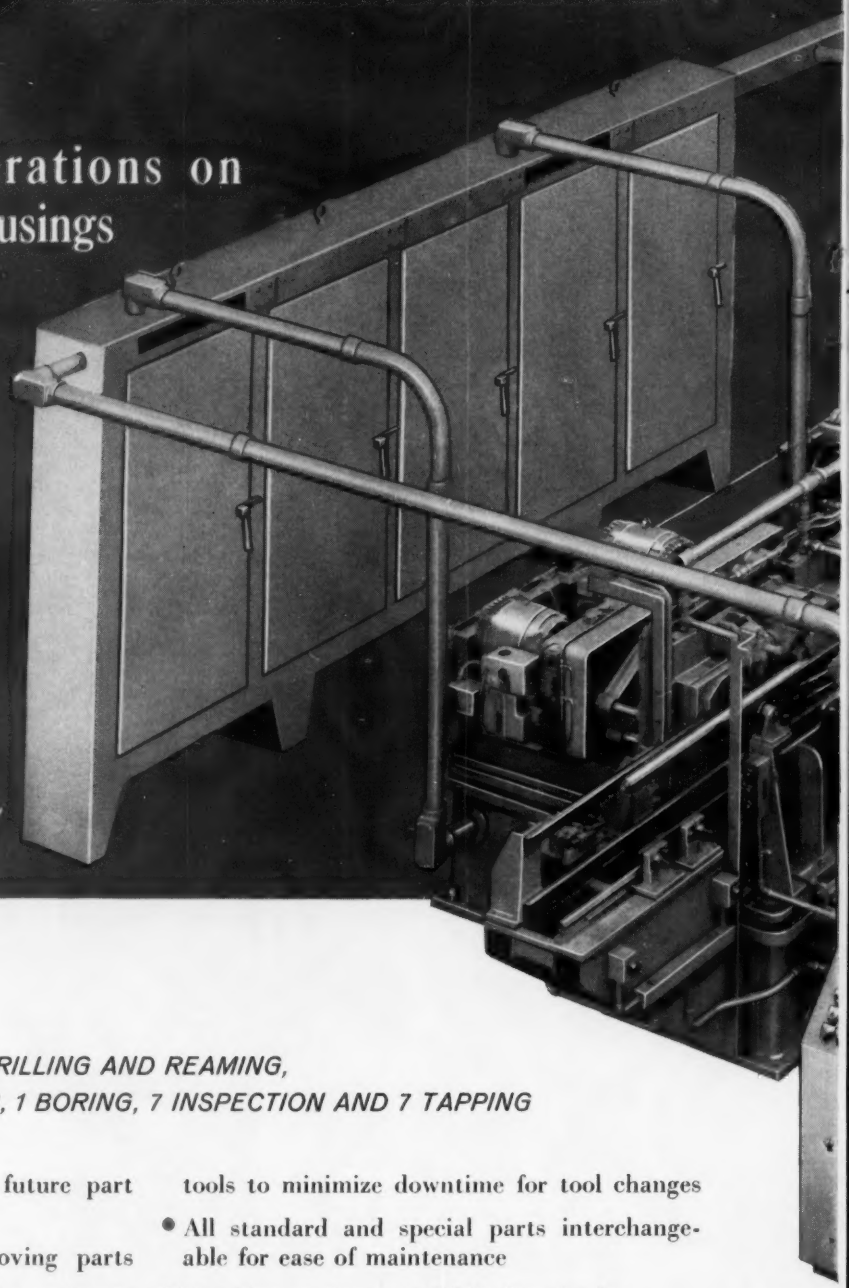
The G. A. GRAY Co., Cincinnati, Ohio



Buhr ECONOMATIC

performs 62 operations on torque converter housings





PRODUCTION...
200 PIECES PER HOUR
AT 100% EFFICIENCY

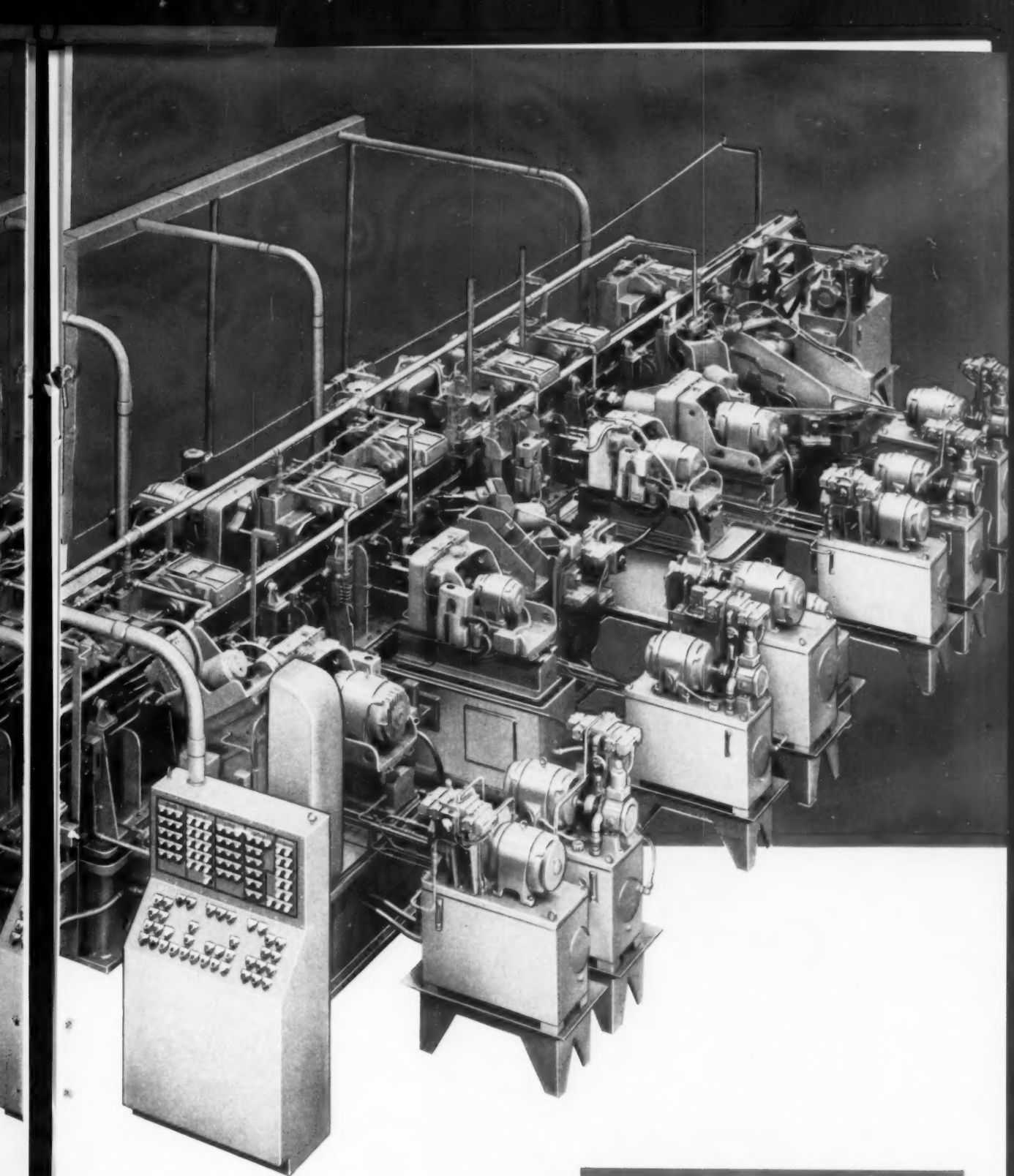
OPERATIONS...
36 DRILLING, 2 COMBINATION DRILLING AND REAMING,
7 COUNTERSINKING, 2 REAMING, 1 BORING, 7 INSPECTION AND 7 TAPPING

- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards
- Hardened-and-ground automatically-lubricated steel ways.

BUHR MACHINE TOOL COMPANY©

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers



Buhr

MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

You may not be

Every one of your machine tools is—in truth —a coin-operated machine. Before anything comes out, you have to put in "coin," even though you don't use nickels.

But it might be better if you did! For then you could spot the "one-arm bandits" before their take is revealed (or simply neglected) on your balance sheets or P&L statements.

You could go *right* to the best opportunities for making high-return investments. You could replace the lemons with jackpots.

Ask your production people for their recommendations and when they specify Avey, you can be sure of the results.

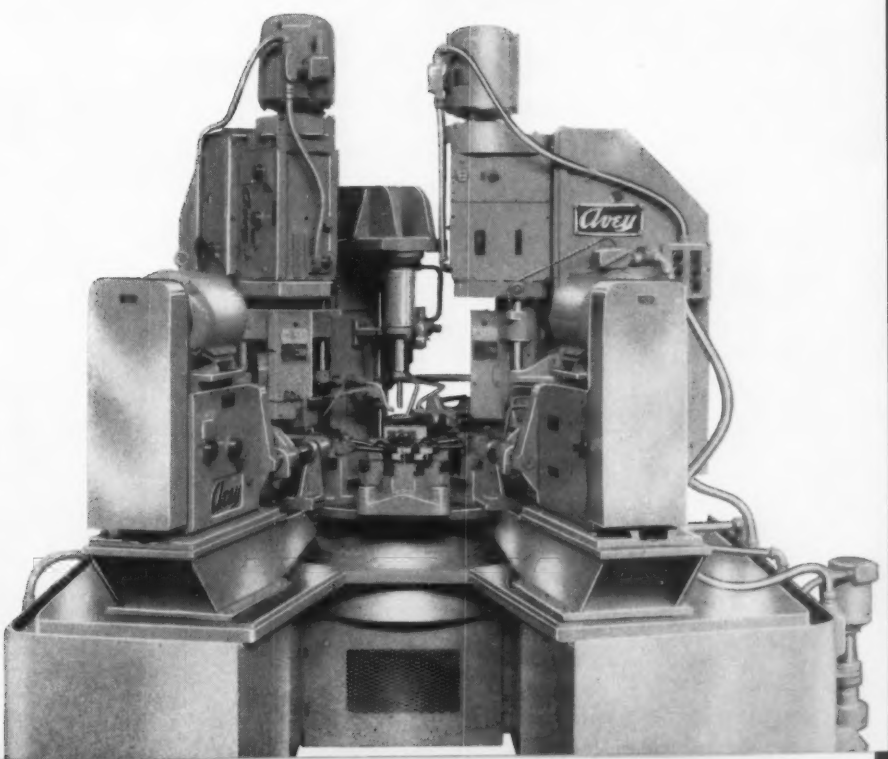
▸ **production data:** This 6-station Avey indexing machine performed drilling, tapping, milling, and broaching operations. Fixtures arranged to handle two different parts. Milling and broaching done in one pass, with cycle time of 8 seconds. Rate: 380 parts/hr. at 100% efficiency.

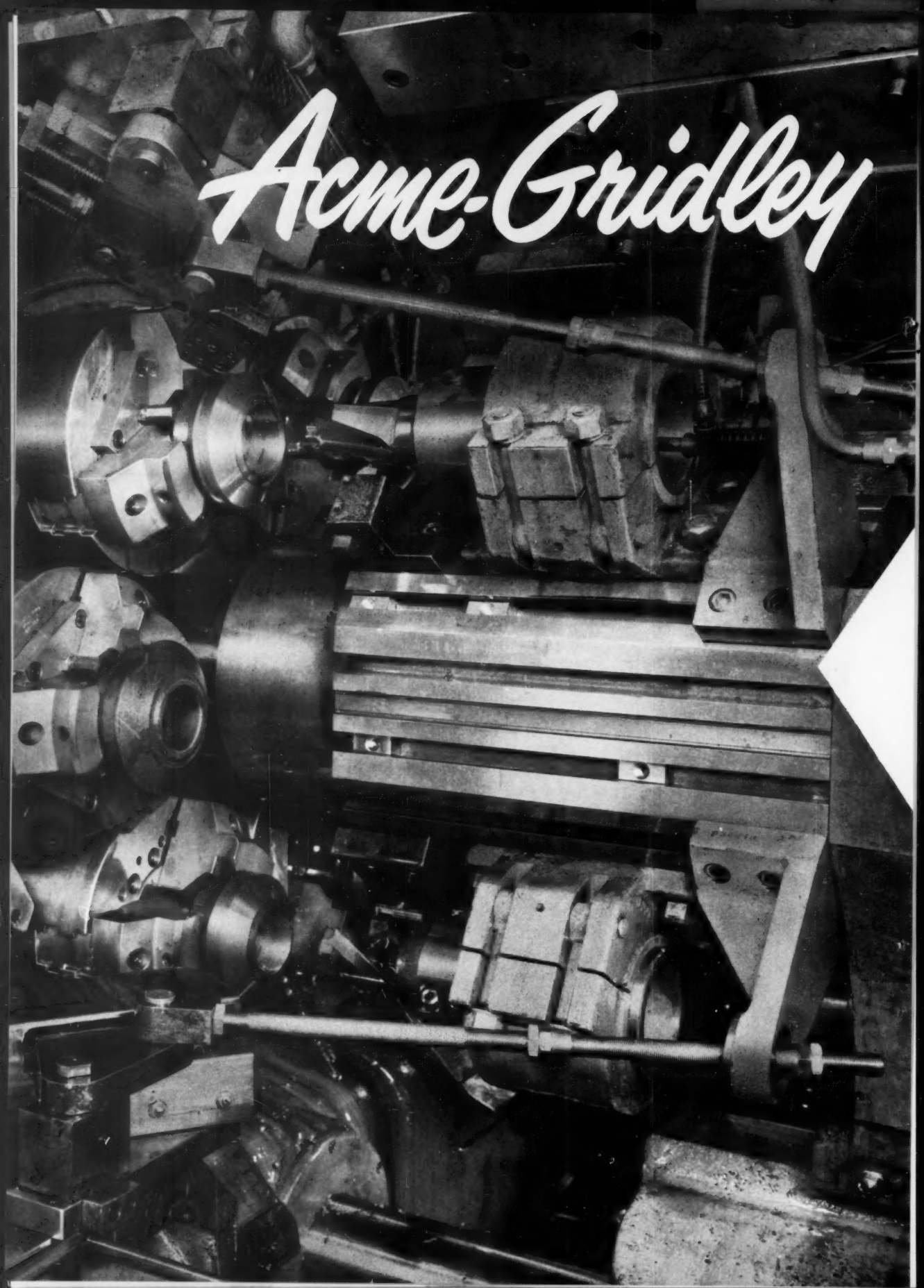
THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

in Las Vegas . . .

Avey




Acme-Gridley

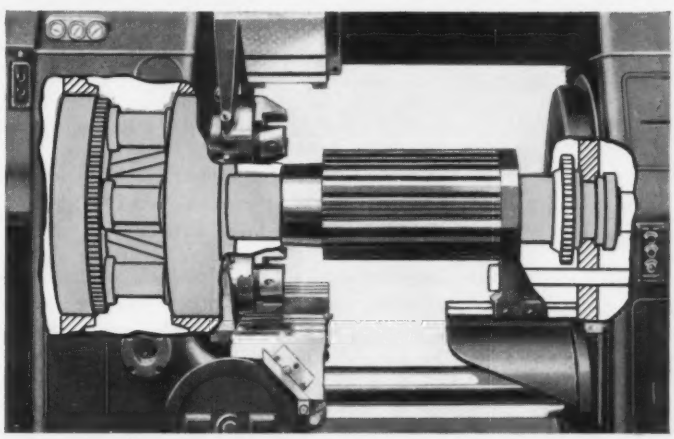
sound basic design

means greater production at lower cost

Accurate alignment of the tools and the work, every time the carrier indexes—and the rigid maintenance of this very precise alignment throughout every machining operation—provides greater precision all day long, less inspection, fewer rejects.

This accuracy resulting from sound basic design is one of the many reasons why Acme-Gridleys are setting new records for consistently accurate production every day.

- Spindle carrier integral with stem.
- End toolslide provided with bushings closely fitted to carrier stem and protected by front and rear seals.
- Toolslide further supported by rugged guide arm to heavy guide plate below carrier stem.
- Two wide spindle carrier bearings in headstock frame and a heavy-duty bearing in gear box provide maximum support.



LET US TELL YOU MORE ABOUT *Acme-Gridley* BASIC DESIGN

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark, N. J. • Chicago, Ill. • Detroit, Mich.

it's easy to recognize the

PRODUCTION VERSATILITY

of this LAPOINTE

electro-motive drive

As shown in these photographs, this double ram machine is broaching stator wheels on the left side and mating blades on the right. Here's balanced production!

However, it could be set up for broaching *all wheels, or all blades — or other comparable parts.* With Lapointe-built broaching fixtures, you can quickly make a change-over to suit your production requirements of the moment.

And we do mean production, for this 40 hp., 100-inch stroke machine broaches at rocket-like speeds up to 300 feet-per-minute! Built for operating right around the clock, 24 hours a day, this heavy duty Lapointe Broaching Machine with electro-motive drive was purposely engineered for mass production.

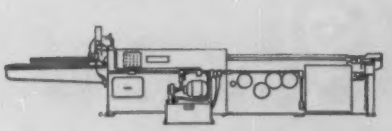
Any questions? We probably have the answers . . . we've been building broaching equipment exclusively for 54 years — longer than anybody else!

THE LAPOINTE MACHINE TOOL COMPANY

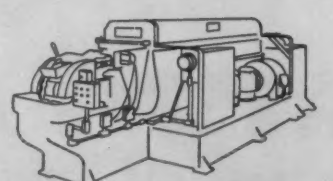
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

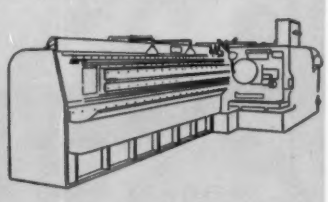
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC

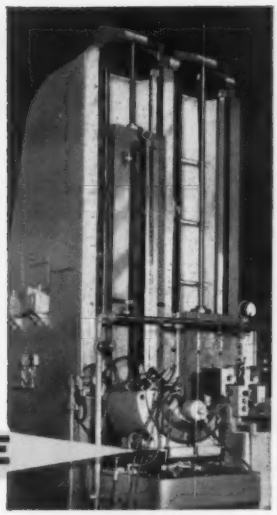


CH CONTINUOUS BROACHING, ELECTRIC



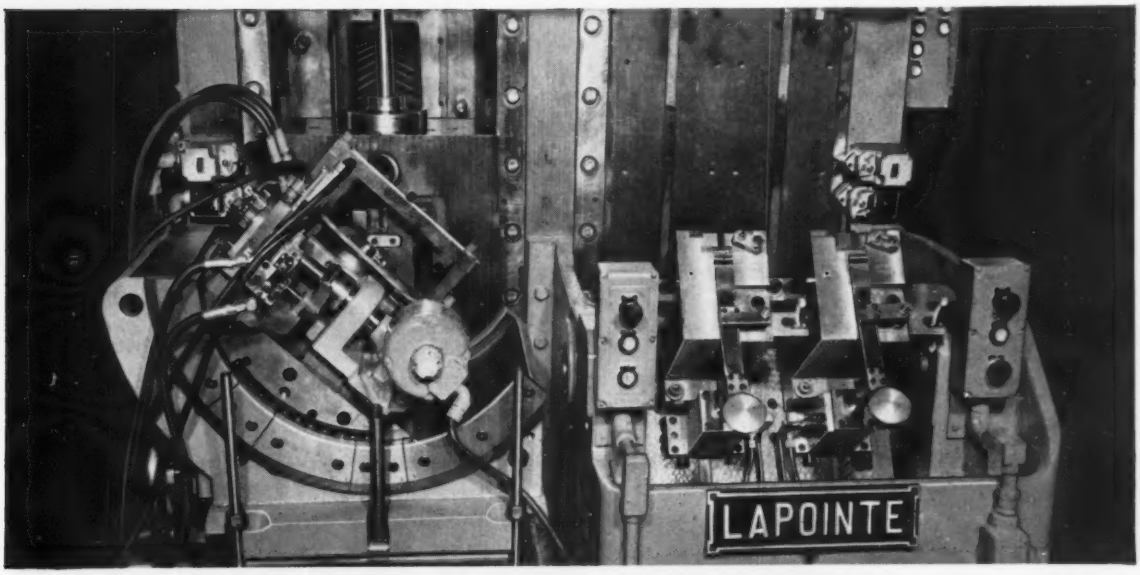
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

BROACHING MACHINE

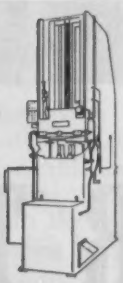


This machine weighs 68,000 pounds. A comparable machine with hydraulic drive weighs only 38,000 pounds. Weight is a most important factor in a broaching machine built for electro-motive drive, as Lapointe has learned through years of pioneering experience in developing electro-mechanical broaching machines.

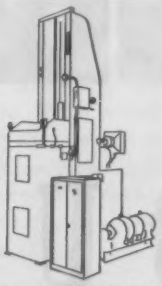
LAPOINTE takes all the responsibility, for your broaching program — we build the broaching *machines*, build the broaching *fixtures*, and make the *broaches!*



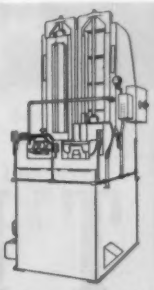
Fixture on the right ram is the patented Lapointe Tip-Down type. The universal fixture on the left ram can be set from 0° to 45° rotatively, and 0° to 30° conically, enabling parts to be processed at a compound angle. Here, it is broaching stator wheel slots . . . 76 of them, equally spaced within .005" of true position.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

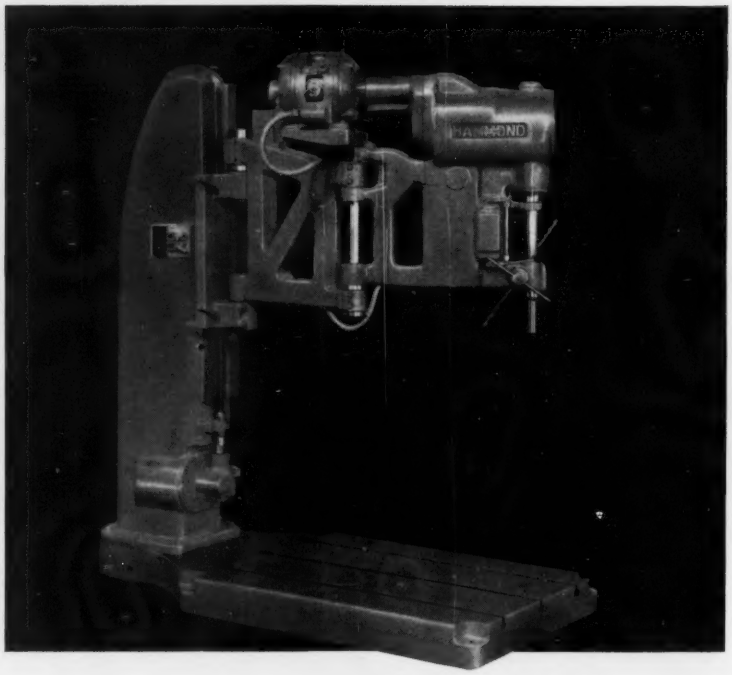


DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

BROACHING MACHINES

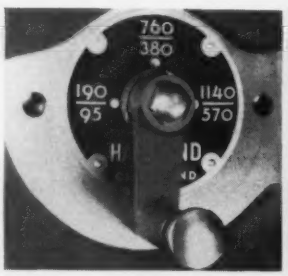
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT
FOOTBURT

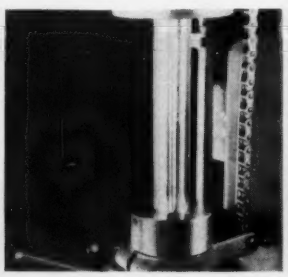


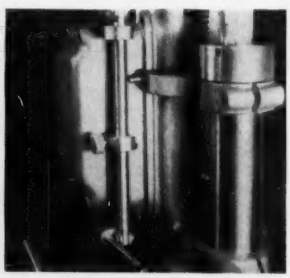
for *faster* radial drilling and tapping

■ Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY · Cleveland 8, Ohio · Detroit Office: General Motors Building







Engineered for production

FOOTBURT

MACHINE TOOLS

For more information fill in page number on Inquiry Card, on page 219

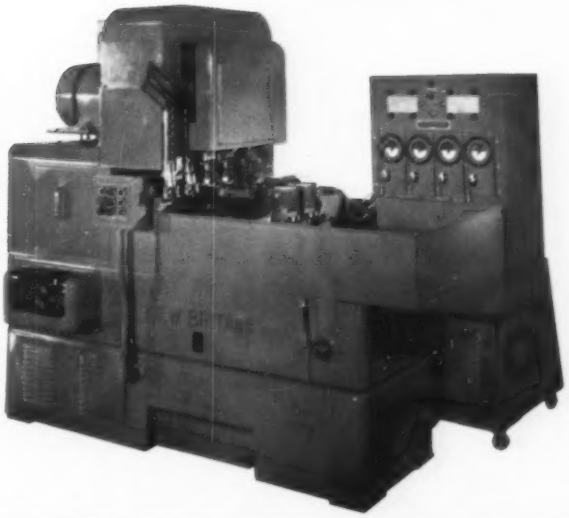
THE NEW BRITAIN MACHINE CO.

Model 37
Precision Boring
Machine

NB

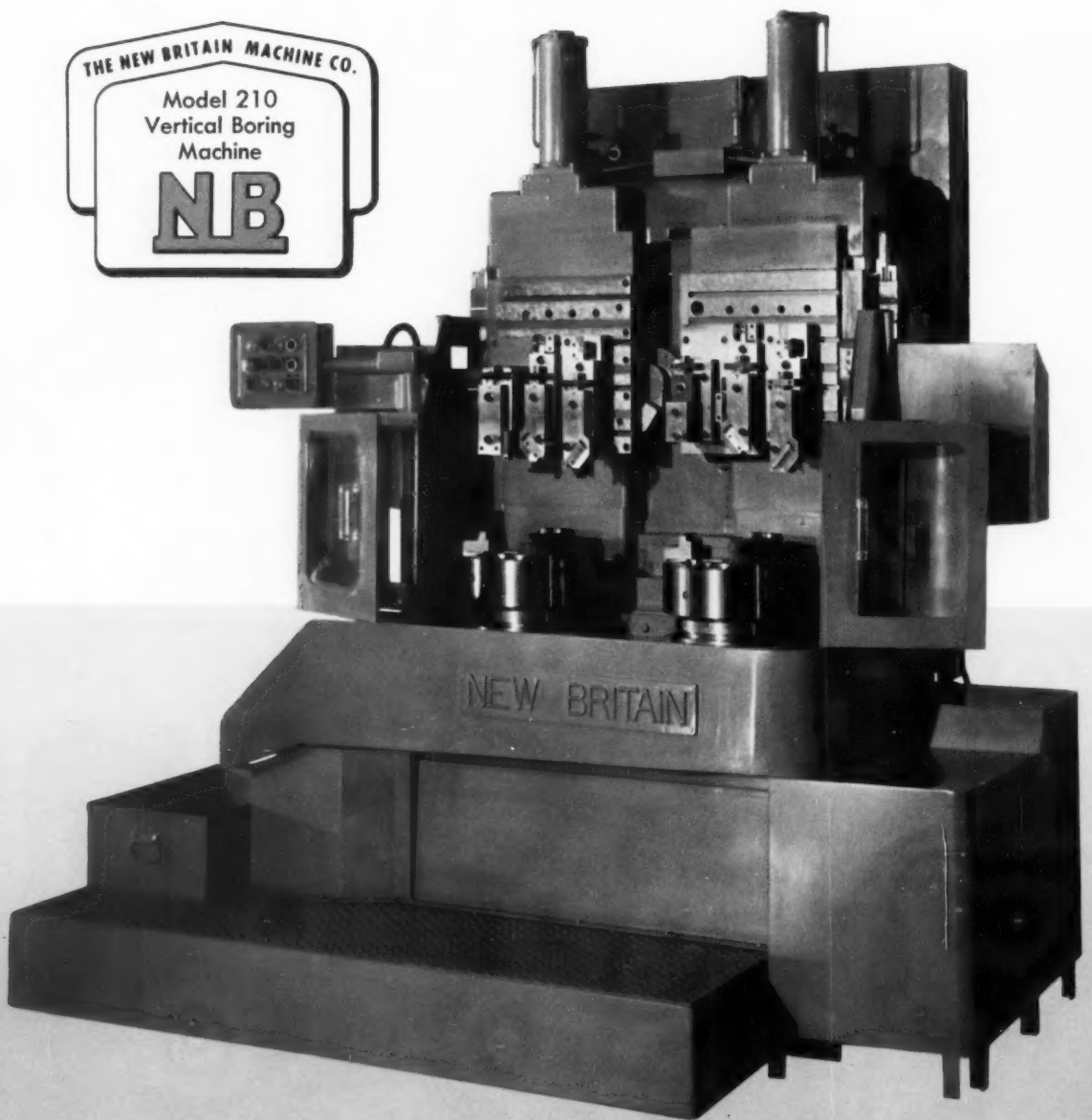
this is
the boring machine
that thinks

As successive pieces approach the limits of a ±.0025 inch tolerance, the tools reset themselves to size. With automatic loading, automatic gaging and two-at-a-time production, this and other New Britain Precision Boring Machines can cut costs for you. Please turn the page for more about New Britain Boring Machines.



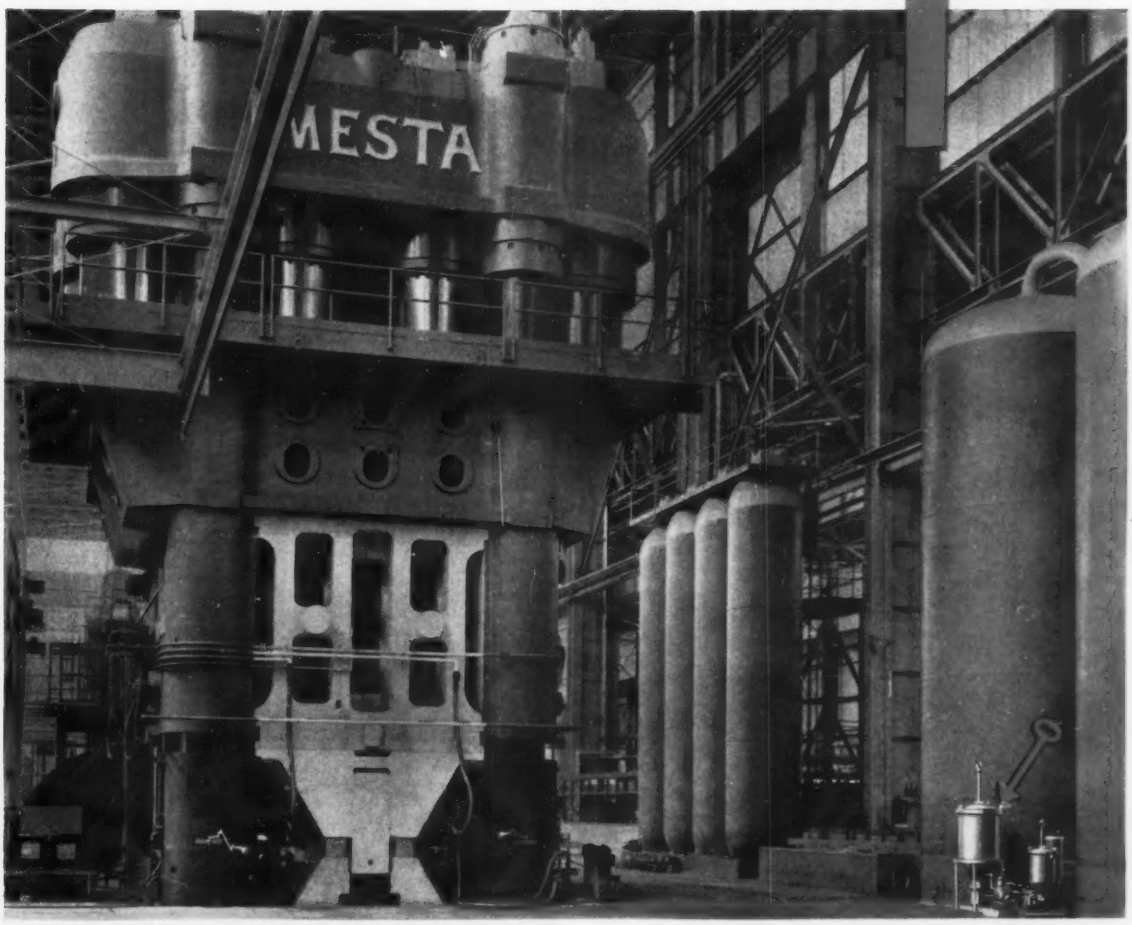
verticals too!

New Britain builds a complete line of straight and contour boring machines, including double-end models, and this Vertical Precision Boring Machine for contouring and turning large parts to close tolerances. More and more the New Britain Sales Representative is your best bet for new and progressive metal-working methods. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Farval automatic system lubricates world's largest forging press at Alcoa

FARVAL—
Studies in Centralized Lubrication No. 185



KEYS TO ADEQUATE LUBRICATION—
Wherever you see the sign of Farval—the familiar central pumping station, valve manifolds, dual lubricant lines—you know a machine is being properly lubricated.

The Farval central stations, visible at lower right, serve this 50,000-ton forging press.

● Pioneer in lubricating presses of all sizes, Farval was chosen to lubricate this 50,000-ton Mesta Press installed recently in the Cleveland works of the Aluminum Company of America.

With equipment of this size, the importance of a lubrication system increases many fold. It *must* be adequate. It *must* be dependable. It *must* function without shutdown. Farval fills the bill—delivering oil or grease unfailingly, in exact amounts required whenever needed. The press is protected, man hours and lubricant saved, guesswork lubrication eliminated, steady production maintained.

You will find Farval representatives ready to serve you in all major industrial centers. See how Farval pays for itself many times over—write for Bulletin 26-R. The Farval Corp., 3276 E. 80th St., Cleveland 4, O.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

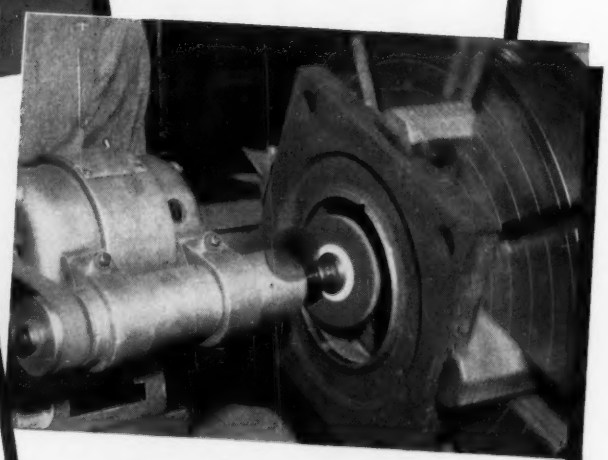
For more information fill in page number on **Inquiry Card**, on page 219

The INSIDE STORY of INTERNAL GRINDING by NORTON

How Norton wheels for internal grinding step up your product quality and profits with the **"TOUCH of GOLD"**

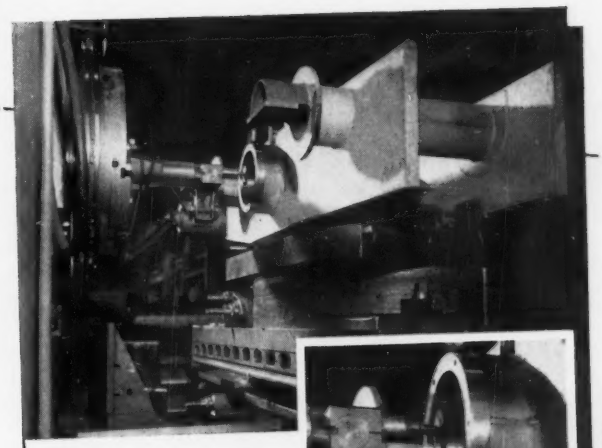
They're Precision-Processed

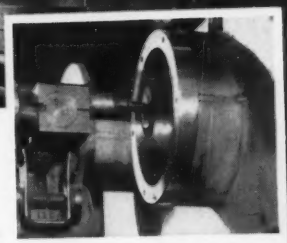
Norton wheels for internal grinding are built by exclusive precision-processing that results in absolutely uniform grinding action, in wheel after wheel of the same specifications. This means you can depend on each Norton wheel of the same specifications for exactly the same grinding action. No fussing with timing cycles when you change wheels — you save on every grinding job. Other typical "Touch of Gold" advantages include their fast, free, cool-cutting action and extra long life. Norton wheels are made in types, sizes, bonds and abrasives for every internal grinding application.



The Famous Norton G Bond

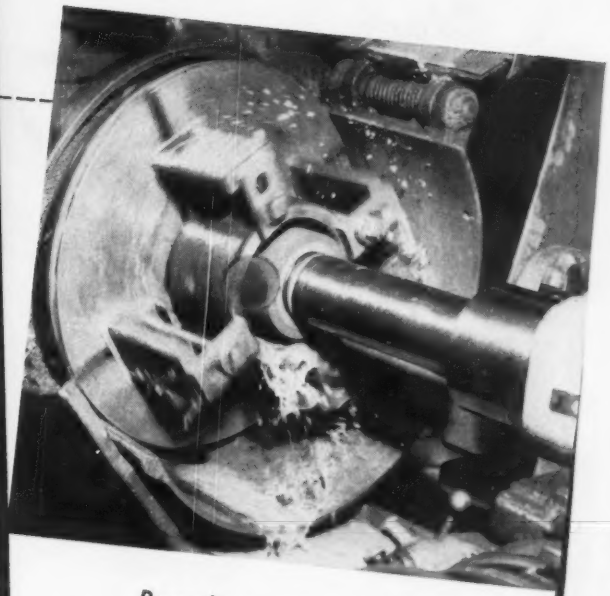
The Norton G Bond is the most efficient vitrified bond ever developed for precision and semi-precision grinding. Holding each abrasive grain just long enough for maximum cutting action, it assures a constant grinding surface of fresh, sharp cutting edges. As a result, G Bond wheels cut cooler and faster . . . produce smoother finishes . . . dress easier and give more pieces per dressing. With Norton 32 ALUNDUM* abrasive — outstanding for heavy feeds and rapid stock removal — it makes an ideal "Touch of Gold" combination for your grinding jobs on steel and steel alloys.





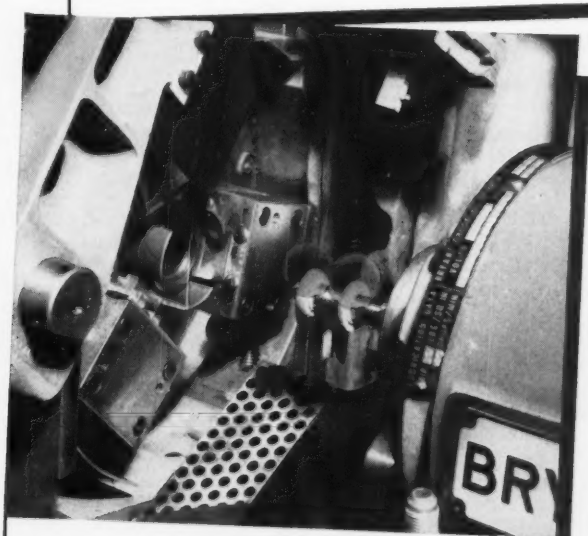
An Unusual Set-Up

Grinding bearing housings with a Norton wheel on a Dumore tool post grinder, mounted on a horizontal boring mill. The grinder itself revolves in a planetary motion, the grinding wheel spindle following the I.D. of the hole. To grind the other end of the housing the work table is turned 180°. *Material:* cast steel. *I.D.:* 7.8737". *Stock removal:* .005" each end. *Limits:* +.0001", −.0004". *Time:* two hours each end



Rounding It Out — Fast

During hardening, a certain amount of warpage occurs in this steel mould band. A Norton wheel is grinding it perfectly round and smooth. The band has an I.D. of 6" and is 4" deep. Average amount of stock removal is .040" and the time cycle is 30 minutes.



Precision Performance — Doubled

Here a Norton two-wheel set-up is ready to go into fast grinding action. The job is grinding a double race in a steering gear bearing. *Material:* SAE 1045 steel, 54 Rockwell C. *I.D.:* 1.1507". *Stock removal:* .012". *Limits:* +.0000", −.0005". *Finish:* 10 microinches RMS.

See Your Norton Distributor

for further facts on how Norton wheels can bring the value-adding, money-saving "Touch of Gold" to your own internal grinding operations. He'll be glad to arrange a test in your plant. Or write direct to your nearest Norton district office. And remember: only Norton offers you such long experience in both grinding wheels and grinding machines. NORTON COMPANY, Worcester 6, Mass. Offices in nine cities. Distributors in all industrial areas — listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated.

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Pressure-Sensitive Tapes

W-1683

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

For more information fill in page number on Inquiry Card, on page 219

New ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

Write for catalog

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of Inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

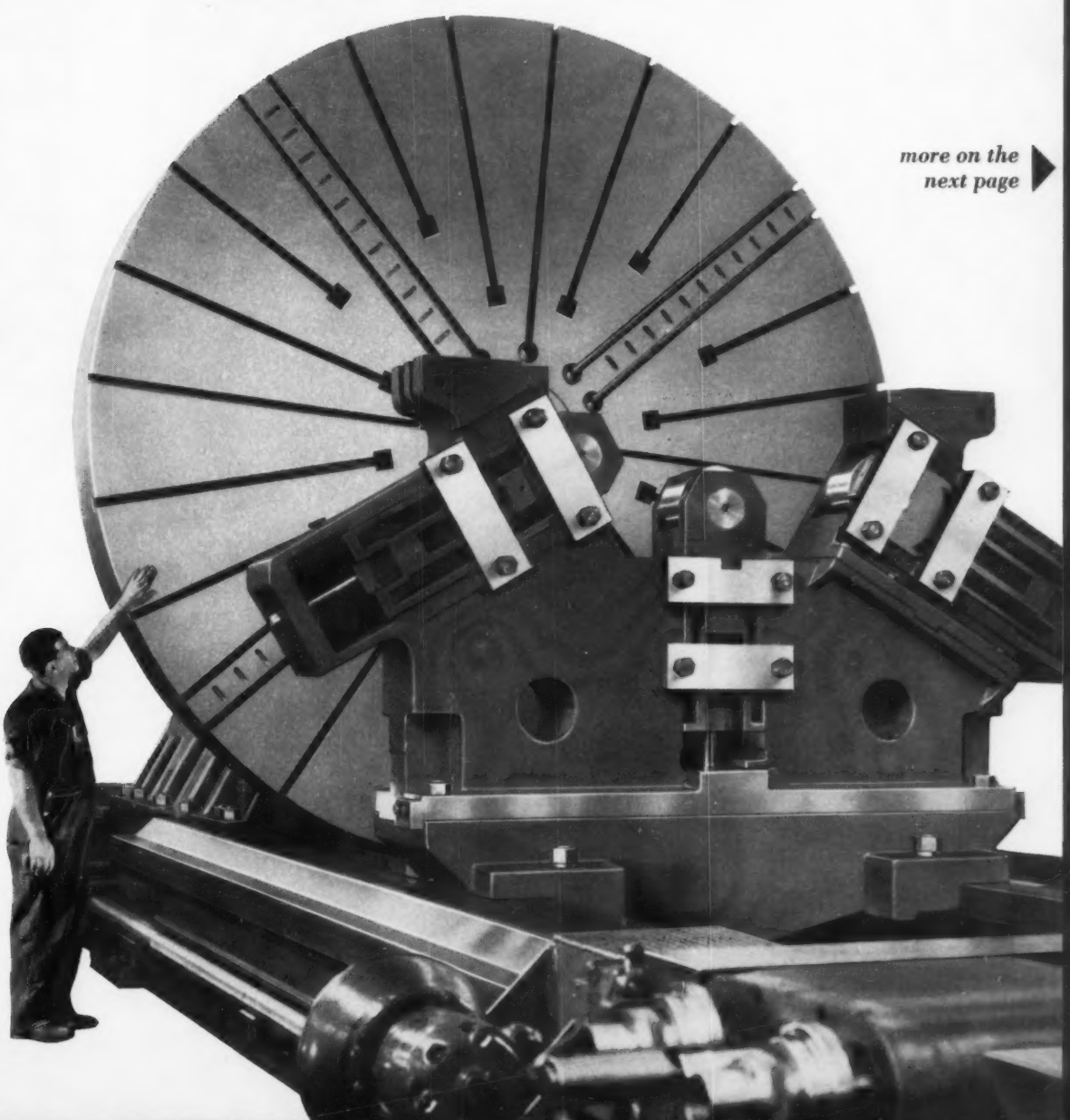
For more information fill in page number on Inquiry Card, on page 219

The man's no midget

He's 6 feet tall and the lathe is the heaviest and most powerful general purpose lathe ever built in the U. S. A.

Consolidated built it of course, and the price (if you are interested) is around a half million dollars.

more on the next page ▶



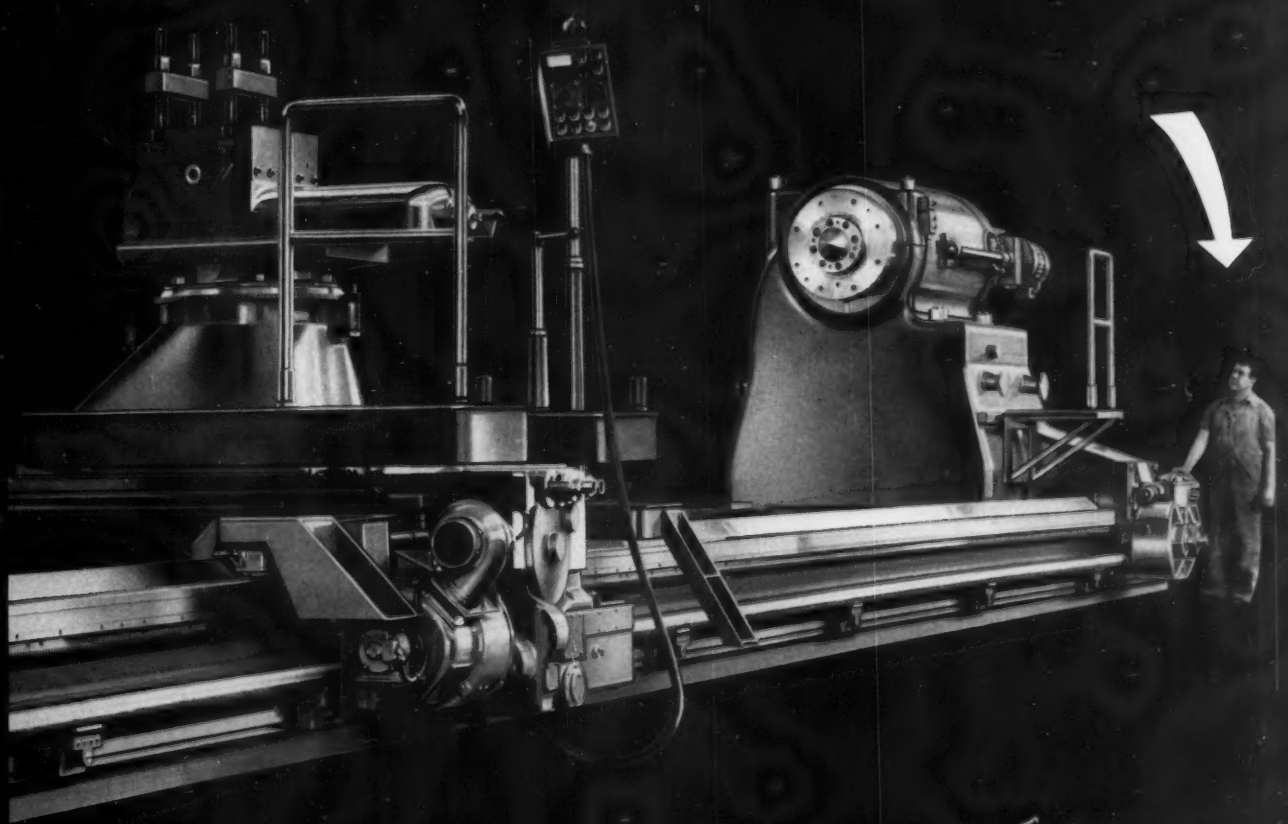
a half-
BETTS

million dollar lathe

. . . the heaviest and most powerful ever built in America!

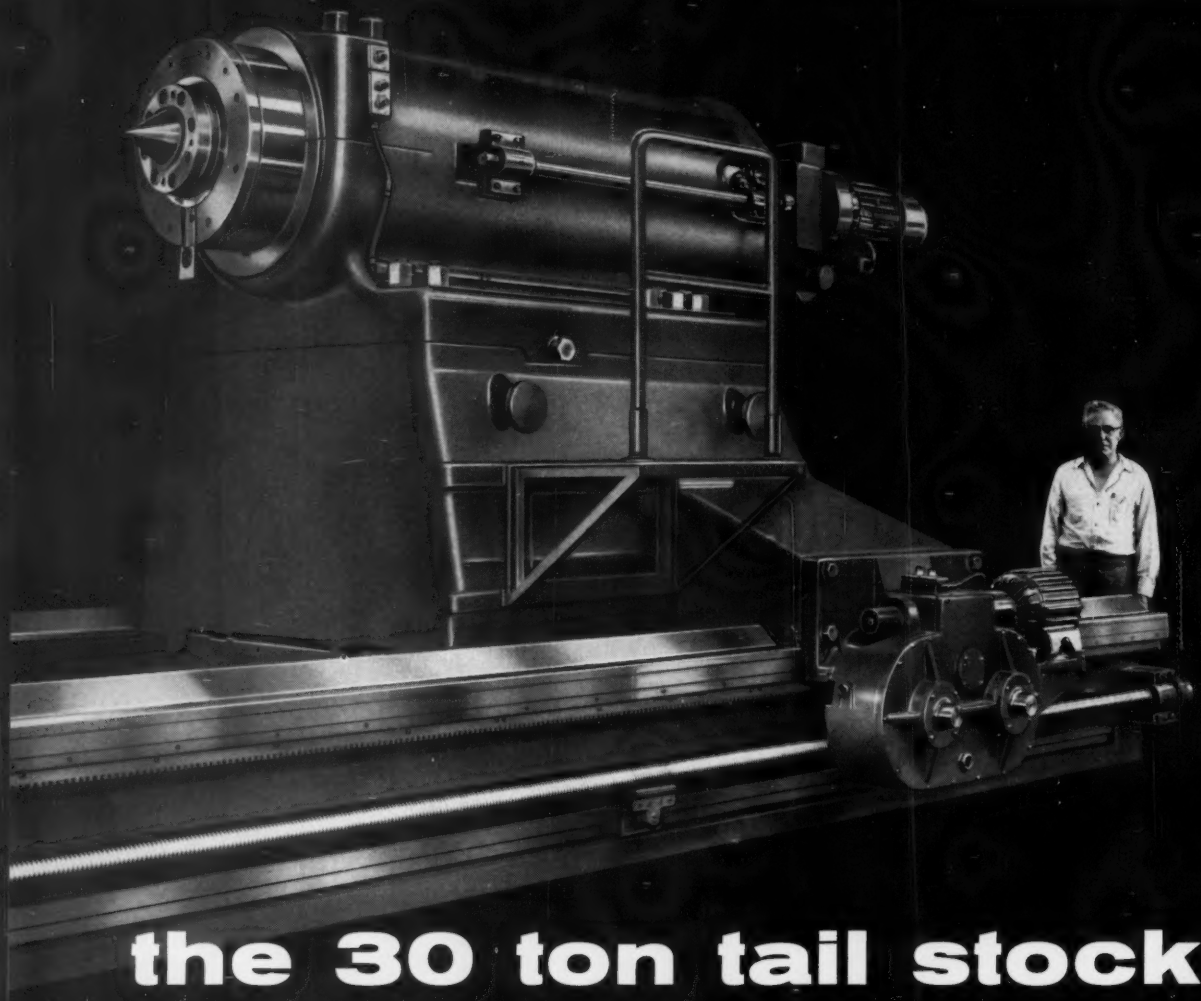
Some highlights on the new 12 foot BETTS HEAVY DUTY LATHE:

- The head and tail stock centers alone (without steady rests) will support work pieces *weighing up to 250 tons!*
- The big super-precision spherical roller type spindle bearings are 36 *inches in diameter!*
- The lathe shown (60 foot centers) weighs 245 tons.
- The front way of the bed is nearly 3 feet wide.
- The taper attachment turns tapers *up to 14 feet long* in one setting!
- The head stock is built for a 250 HP driving motor.



Advertisement | CONSOLIDATED MACHINE TOOL CO.

more on the next page



the 30 ton tail stock

Its huge live center revolves in precision roller bearings nearly two feet in diameter.

These lathes are big, but more than bigness is the quality of engineering thinking that goes into them.

For example, this big lathe is electronically controlled. The operator runs it at the cutting tools with his eyes on the cut. Infinitely variable feeds and speeds are on a portable panel at his finger tips and he can change them in fine increments *while the tools are cutting!* Power traverse is there, too. There are also such features as the adjustable spring loaded tail stock spindle that compensates for the elongation of the work piece as its temperature rises.

This is the kind of thinking that goes into Consolidated Machine Tools.

CONSOLIDATED MACHINE TOOL CO.

ROCHESTER, NEW YORK

CONSOLIDATED MACHINE TOOLS

A DIVISION OF FARREL-BIRMINGHAM CO., INC.

F/B

"They got Faster honing ...with 1/3 less stone pressure!"

A large manufacturer recently had a problem in engine cylinder honing after boring. Excessive time was required to bring the cylinder to the final dimension, and stone wear was high. The two honing oils being used seemed at fault.

R. J. Hughes, Sinclair Industrial Representative reports: "We made a routine call on their purchasing department at the time this situation was under study. They asked us for our solution. Based on previous experience with problems of this type, we recommended Sinclair HONOL® Light. The company agreed to test it."

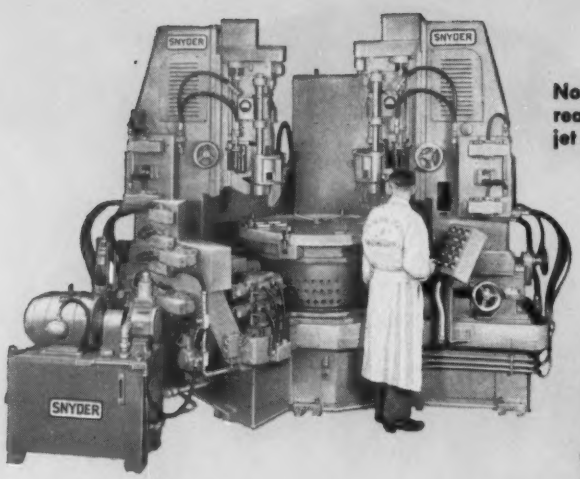
DIAL READING REDUCED FROM 4 1/2 TO 3!

"Test results were conclusive," continues Mr. Hughes. "On the same work, Sinclair HONOL Light substantially increased tool efficiency over the two competitive oils. Back pressure on the stone was reduced from a dial reading of 4½ to 3 . . . a 33⅓% reduction . . . *while accomplishing the same rate of removal!* Naturally, this company decided to convert all of their honing machines over to HONOL Light," concludes Mr. Hughes.

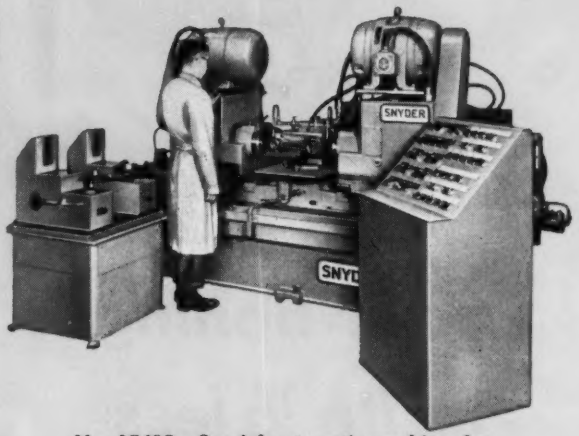
If you have precision honing machines it will pay to get the facts on Sinclair HONOL Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Ave., New York 20, N.Y. *There's no obligation.*

SINCLAIR

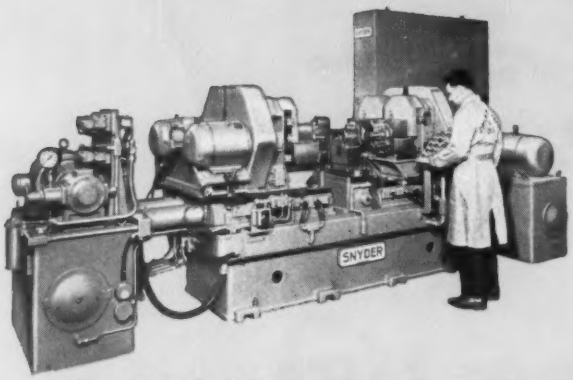
CUTTING OILS and COOLANTS



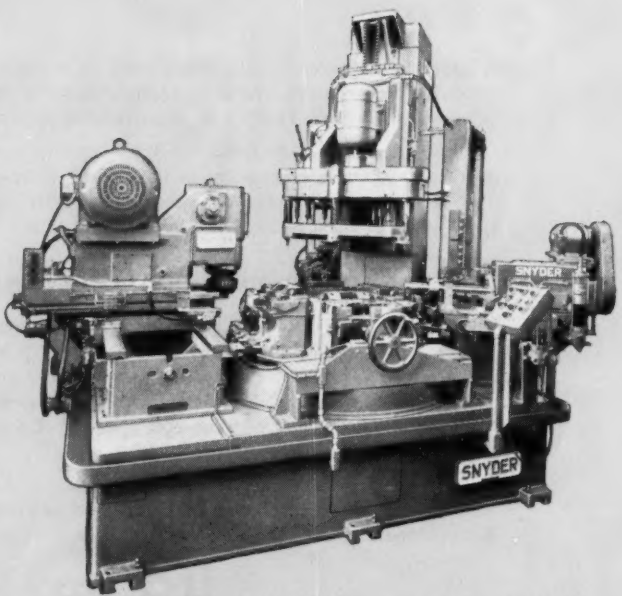
No. 70165—Special index machine to drill and ream holes in rims of outer shroud spacers for jet engines. Production 2 parts per hour.



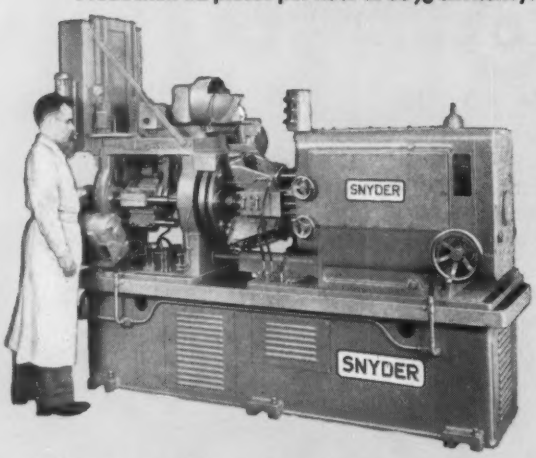
No. 65412—Special automatic machine, for weighing and precision balancing a variety of heavy-duty and diesel engine connecting rods from 7⅜″ to 12″ center distance. Weighs rods and automatically balance mills to plus or minus 2 grams.



No. 207390—Special, double-end precision boring machine for finish boring, counterboring and chamfering counter shaft, intermediate and shifter shaft holes on power take-off cases. Production 82 pieces per hour at 80% efficiency.



No. 73902—Special 4-station automatic index machine for milling joint face, drilling and reaming vertical and horizontal holes in exhaust manifolds. Production 80 pieces per hour at 80% efficiency.



No. 68526—Special double end trunnion machine, fully automatic, for machining special aircraft rivets. Machine is automatically loaded and unloaded. Production rate varies with size of rivet.

SNYDER VERSATILITY

in engineering and building metal-cutting machines includes not only the great Snyder line transfer machines with automation, but also many smaller and diversified machines in which the standards of performance and economy are no less exacting. A few representative examples are shown.

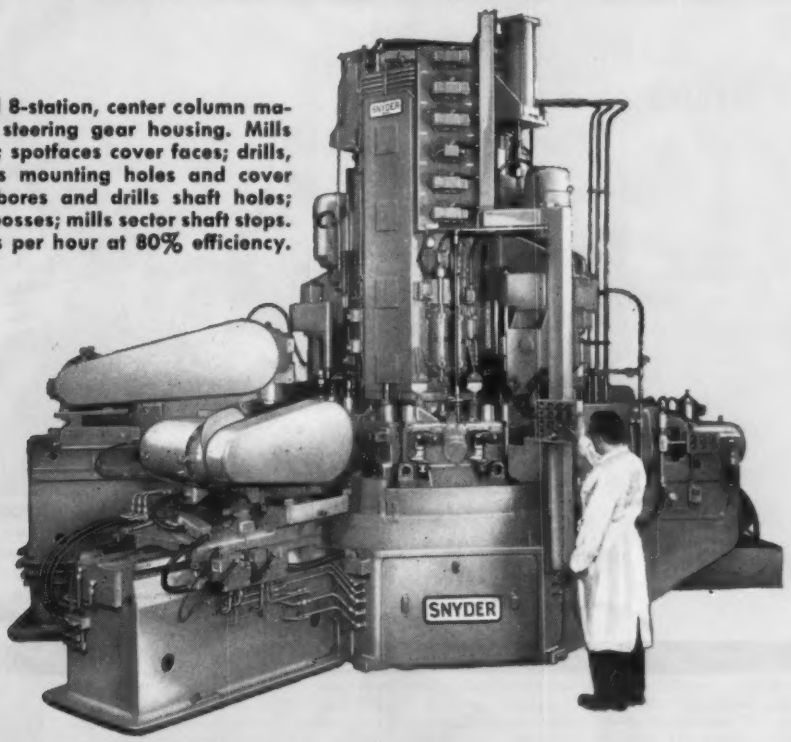
SNYDER

TOOL & ENGINEERING COMPANY

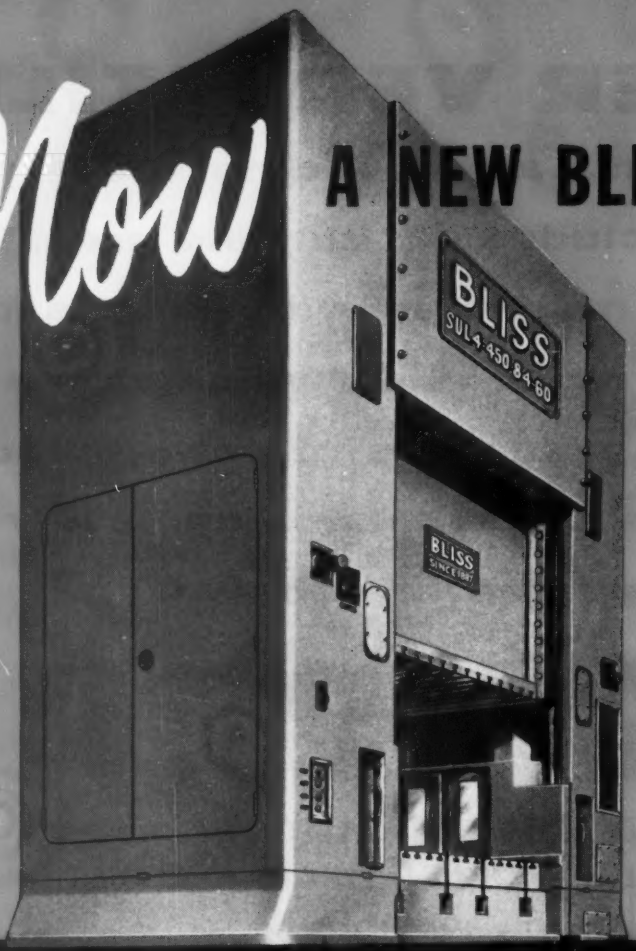
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

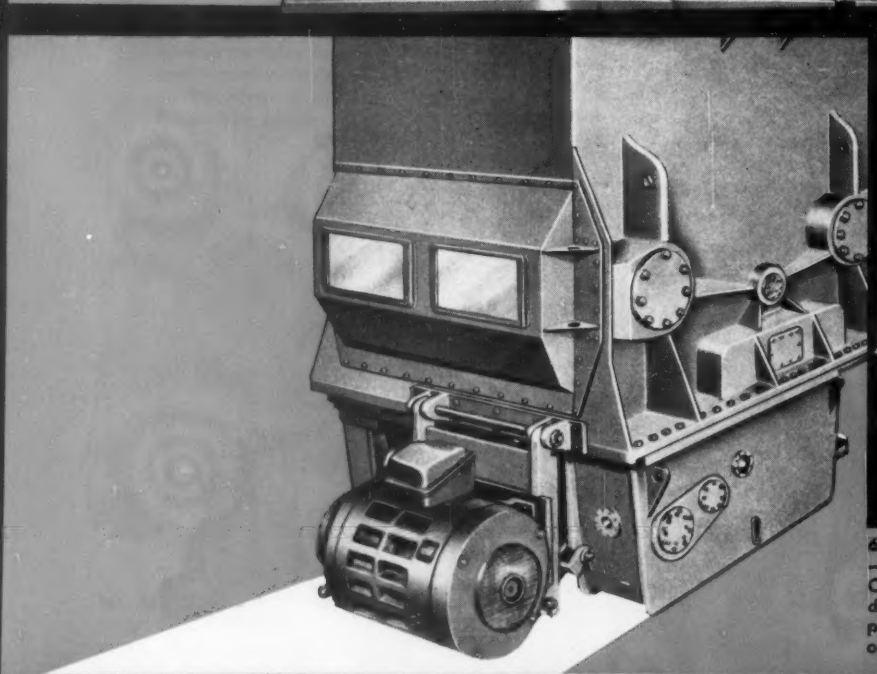
31 Years of Special Machine Tools with Automation

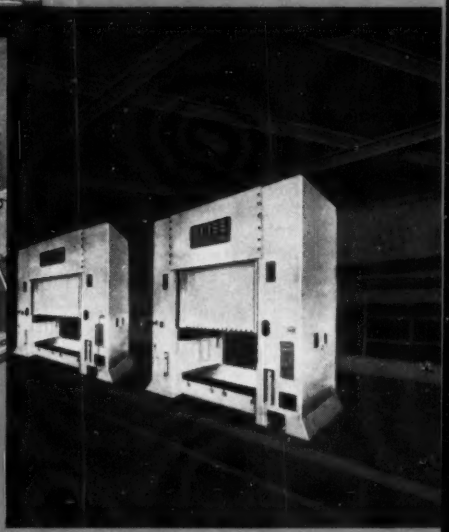
No. 72976½—Special 8-station, center column machine for processing steering gear housing. Mills pads and cover faces; spotfaces cover faces; drills, countersinks and taps mounting holes and cover holes; rough counterbores and drills shaft holes; mills two Welch plug bosses; mills sector shaft stops. Production 260 pieces per hour at 80% efficiency.



Now A NEW BLISS PRESS







600-TON PRESSES IN ASSEMBLY —Shown in assembly at Bliss' Canton, Ohio plant are these three underdrive presses. More than half of each press is beneath floor level. Note observation "ports" in the uprights.

COMBINES LINK-TYPE MECHANISM WITH *Underdrive*

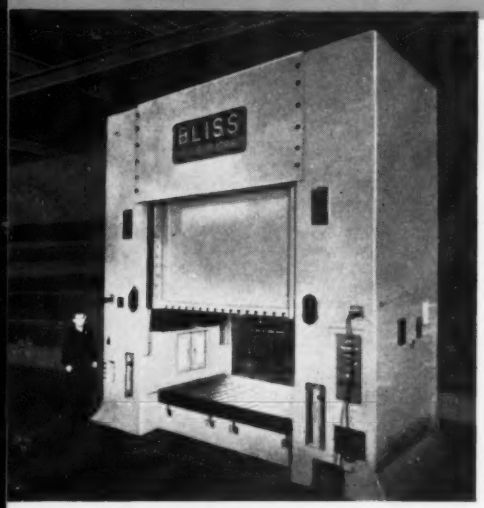
ROCKSHAFT IN NEW UNIT PROVIDES MAXIMUM PRESSURE ON DIES WITHOUT COMING TO BOTTOM DEAD CENTER

A completely new development in press design now offers press users the famous Bliss link-type drive in a low-slung "pull-down" press. The reduced headroom required makes the new press ideal for installation in modern one-story plants.

The link-drive rockshaft mechanism has been designed to come to within a few degrees of bottom dead center when the slide is down. This develops maximum pressure on the dies and eliminates a major cause of sticking.

Bliss engineers evolved the new design from the link-type overdrive press, which Bliss developed and introduced two decades ago. The "non-sticking" advantage of the new press is only one of the reasons why many have already been ordered by automotive manufacturers. Built to J.I.C. standards, these "packaged" units have all piping and wiring for press controls, automatic work-handling devices and maintenance tool power outlets built into their trim, rugged uprights. Installation is simply a matter of "plugging in" electrical and other connections. Adjustment is fast and precise, thanks to the motorized worm and wheel adjustment at all corners of the slide.

These are just a few of the many design features which make Bliss' Link-Type Underdrive presses among the most modern in the world. You ought to have the complete story in your files—and *can* by writing today to our Canton office.



THESE DESIGN ADVANTAGES SLASH OPERATING AND MAINTENANCE COSTS!

- Slide gibs protected against dirt and grit in all positions of stroke and adjustment.
- Swivel mounting on counterbalance cylinders eliminates misalignment of piston rod and cylinder.
- Packaged clutch and brake unit: standardized and unitized; gear type coupling between clutch and brake unit and press.
- All main drive gearing located in single removable gear case.
- Automatic lubrication of counterbalance cylinders and cushion internals.
- Plexiglass observation windows in uprights and gear case permit easy inspection of mechanism during operation.
- Two lubrication systems—one low pressure, the other high pressure; both interlocked with the press run circuit.

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Rolls, Special Machinery

BLISS
SINCE 1857

is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Calif. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

A CINCINNATI PRESS BRAKE

accurately forms this difficult shape

Cincinnati Features

Insure this Accurate Performance

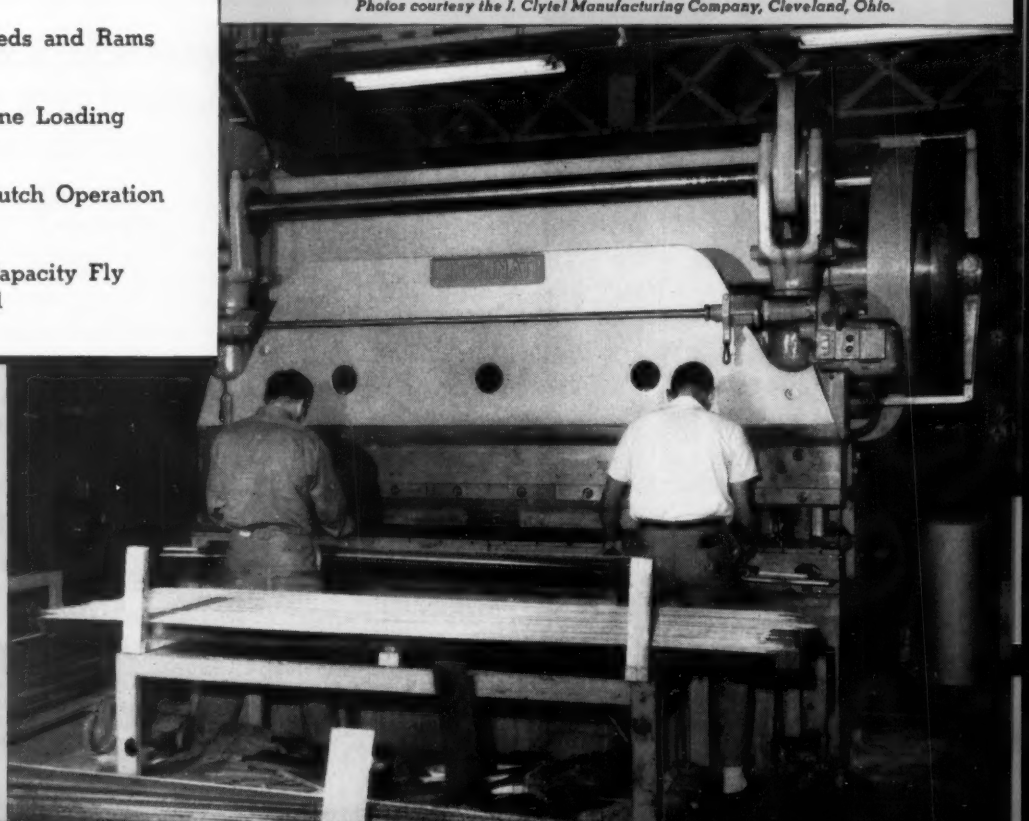
- All-Steel Interlocked Frame
- Deep Beds and Rams
- Centerline Loading
- Easy Clutch Operation
- Large Capacity Fly Wheel

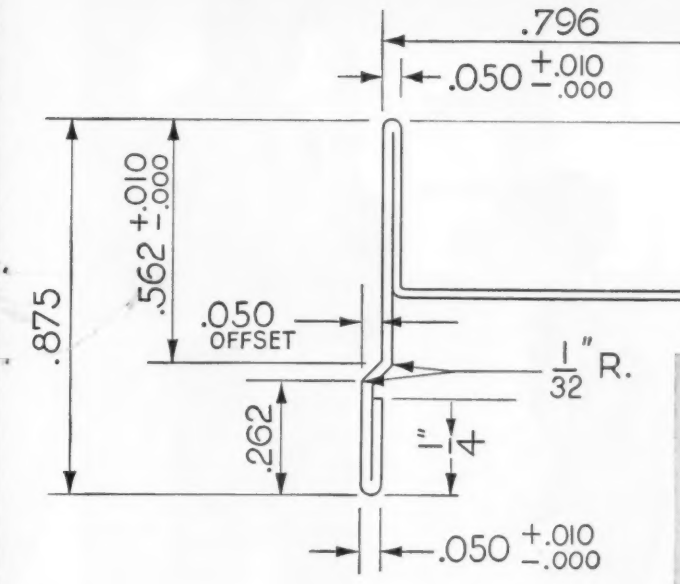
. . . at THE J. CLYTEL MANUFACTURING COMPANY

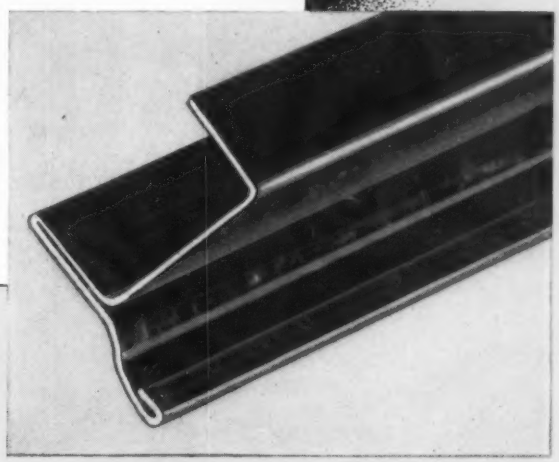
Metal Fabricators

CLEVELAND, OHIO

Photos courtesy the J. Clytel Manufacturing Company, Cleveland, Ohio.





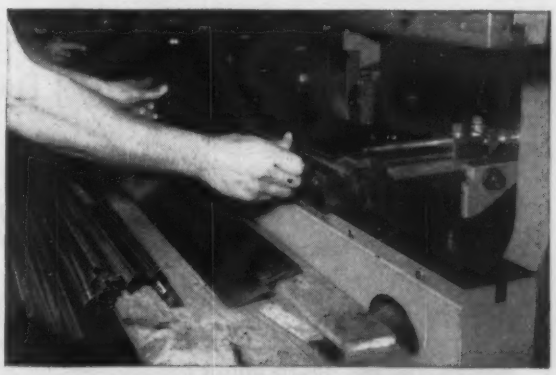


These galvanized steel channels for sliding window frames must be formed straight and true, and all dimensions held to close tolerances.

The Clytel Company say: "Our press room feels that only Cincinnati makes Press Brakes."

Consult our engineering department on your forming problems.

Write for comprehensive Brake Catalogue B-4.

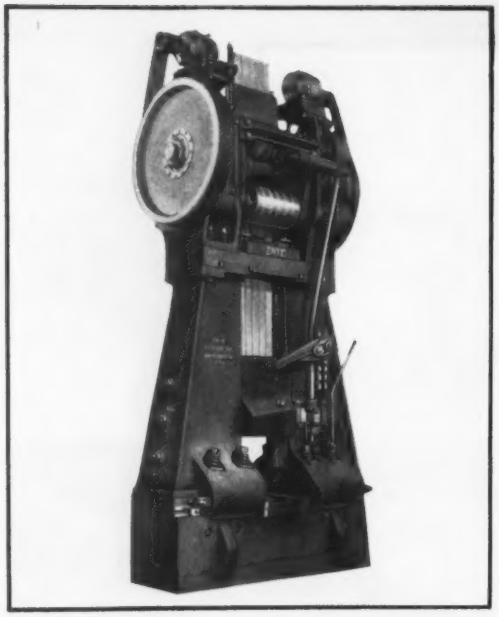


One of the efficient die set-ups used on this job

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



"Gee, Dad--I bet you forged it in one impression on that big 10,000-lb. Board Drop Hammer!"

let your Youngsters learn about FORGING

If you have a raft of kids—send for a raft of books:

ERIE FOUNDRY CO., ERIE, PA.

Send_____"FORGELAND U.S.A." Books to:

NAME_____

FIRM_____ TITLE_____

ADDRESS_____

CITY_____ STATE_____

Quiz kid? Mmm, not exactly. It's that Erie Foundry book in his back pocket that did the trick.

What? A forging book for *kids?*

Well you see, we've been thinking that it would be kind of nice to have the youngsters (yours and ours) understand this forging business a little. Might make them think Pop's *almost* the man Superman* is.

So we poor, unsung fathers at Erie had the exciting story of "Forgeland, U.S.A." put in a book—in the kind of language youngsters understand—with pictures too!

And you're welcome to a copy—or several . . . *for free, of course.*

**absolutely guaranteed to make Pop a hero*

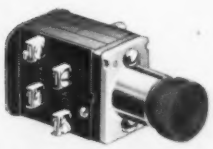
ERIE

ERIE FOUNDRY CO. ERIE, PA.

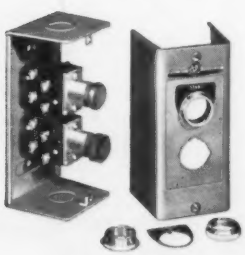
"OUR 61st YEAR"

FORGING HAMMERS • TRIMMING PRESSES • HYDRAULIC PRESSES AND ALLIED EQUIPMENT

ALLEN-BRADLEY
HEAVY DUTY PUSH BUTTONS



Bulletin 800 heavy duty STOP button ready to mount in enclosure. (See below)



A small stock of standard components lets you assemble any special heavy duty station. There is no waiting for special push button stations.

These new Bulletin 800 heavy duty push buttons are the modernized version of that old reliable line of A-B heavy duty stations. Advantages—until now restricted to the oiltight stations for machine tool use—have been built into these new heavy duty stations—and you'll like the result.

For instance, each button or pilot light is a self-contained unit which can be mounted singly or in groups—vertically or horizontally—in a variety of standard Allen-Bradley enclosures, with the name plate reading in the right direction. Double break, silver alloy contacts used throughout. Send for Bulletin 800.

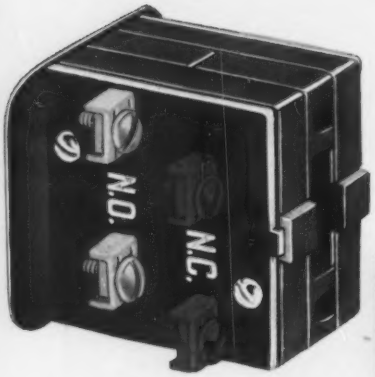
Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

A-B Quality

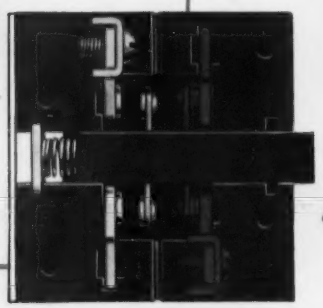
In Canada
Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
QUALITY
BULLETIN 800 PUSH BUTTONS

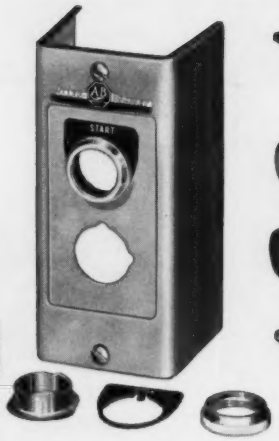
5-56-MR

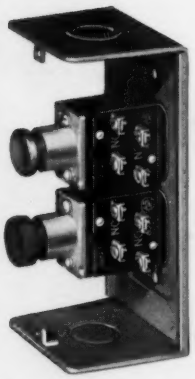


Left—External view of contact block showing N. O. & N. C. terminals.



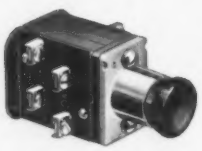
Right—Internal view of contact block showing double break N.O. & N.C. stationary contacts. The pushrod carries the moving contacts.



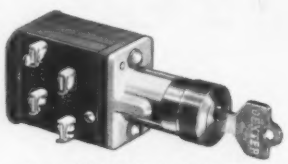


Two button station with name plate and clamping ring removed from cover.

A NEW LINE OF ALLEN-BRADLEY HEAVY DUTY PUSH BUTTONS

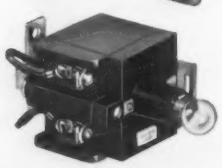


Type AK1B flush head START button



Type EK11B cylinder lock unit

Type HK11B wing lever selector switch unit



Type PK16 pilot light with 110 v, 60 cy. transformer. Available with 220-440-550 v, 60 & 25 cy. transformer

Allen-Bradley heavy duty push buttons have been redesigned to take advantage of the type of construction that has made A-B oiltight machine tool stations so popular.

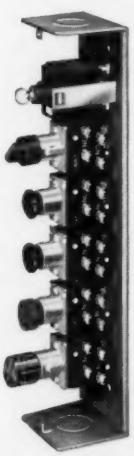
While the new Bulletin 800 heavy duty line is not oiltight, it uses contact blocks that have proved so dependable in the Bulletin 800T oiltight push buttons. Special heavy duty stations can be assembled on the job from a small stock of standard components.

Several types of operators are available, such as standard head, mushroom head, coin slot, key type, wing lever, and 2 or 3 position selector switches. The buttons can be supplied in different colors.

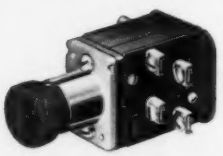
These push button stations can be easily arranged for either vertical or horizontal mounting —with the name plates reading correctly for the desired mounting.

Standard enclosures accommodate up to 8 buttons and pilot lights. Enclosures for more than 8 units can be supplied. Write for Bulletin 800.

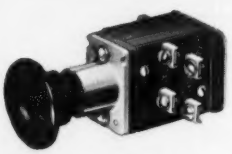
Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.
In Canada
Allen-Bradley Canada Ltd.
Galt, Ont.



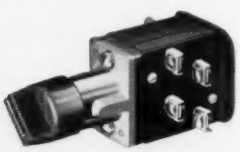
Five button station with pilot light



Type BK6B ext. head STOP button



Type DK6B mushroom head button

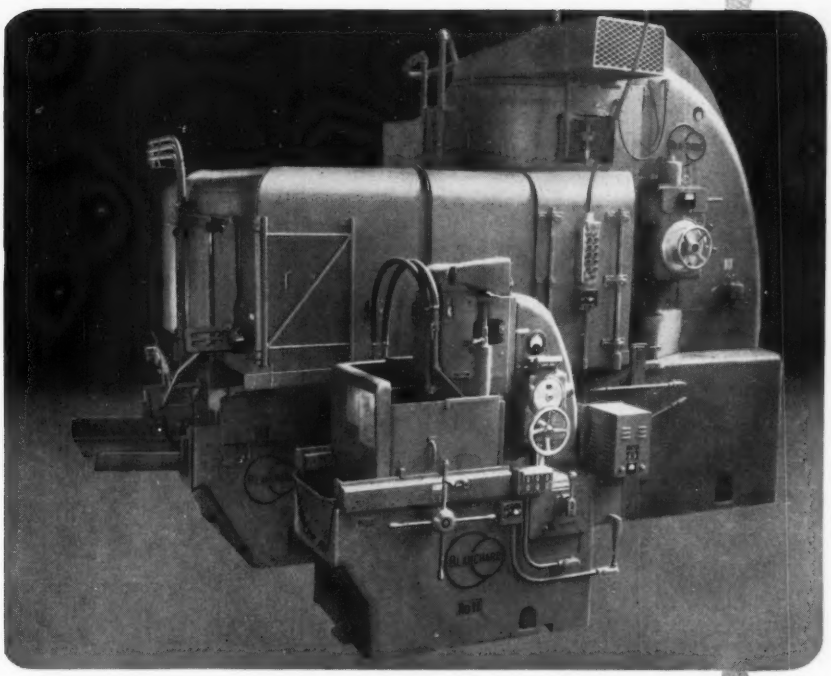


Type HK2B selector switch

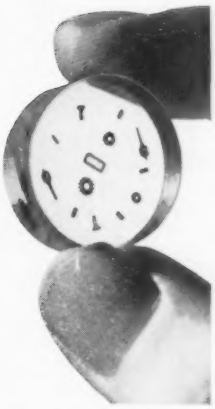
Type FK2B 2 button interlocked station

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

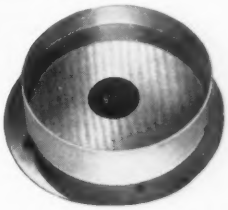
5-56-MR



V-488



Tiny watch gears, pinions and ruby bearings — flat and parallel — to a dimension tolerance of .0002″.



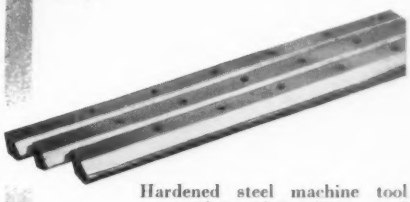
To 3 micro-inches and flat within *one* light band.

Please give us a chance!

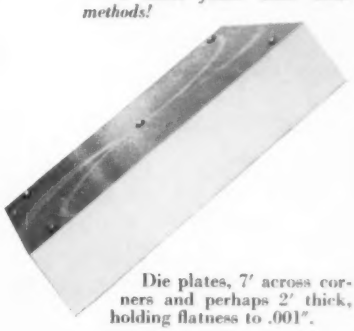
We *know* we can do *your* flat surface jobs. We've done them all — tiny watch parts . . . steel plates 7 feet across corners . . . copper and ceramics . . . *perfectly*. Just give us the correct wheel . . . (Blanchard wheels are preferable).

Blanchards regularly grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001″, with dimension tolerance of .0002″ and surface finish to better than 3 micro-inches.

Honest, we Blanchards (15 models) work fast and inexpensively — whether the job requires precision grinding or rapid removal of stock. Give us a chance to prove we're the best investment you ever made.



Hardened steel machine tool ways, 2½″ x 3½″ x 50″, ground on 6 sides, flat within .001″ with surface finish of 5 micro-inches — *5 times faster than other methods!*



Die plates, 7′ across corners and perhaps 2′ thick, holding flatness to .001″.

Send for free copies of "Work Done on the Blanchard" (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

For more information fill in page number on Inquiry Card, on page 219

It's not always possible to launder *all* the chips or filings out of ordinary wiping material. Chips come back to scar men and metal, to plague your production line. This man has already had four wiper cuts.

He had 4 wiper cuts last month

They're easy to distribute . . .

They really soak up oil . . .

Always a clean one handy . . .

Just toss 'em in the trash . . .

Chips can't hide in a clean Scott Wiper. Each Wiper is brand new, fresh from the carton. A man takes a Scott Wiper as he needs it . . . uses it for his face, his hands, his product.

...He had none!

The difference is . . . Scott Wipers

This is sanitary wiping. A man uses a Scott Wiper thoroughly, throws it away—takes a new one. No danger of cuts from hidden chips . . . no fear of skin infection from dirty wipers . . . when you take a fresh wiper from the carton.

And because Scott Wipers are disposable you save in many other ways. Sorting and baling are eliminated. Handling and distribution are simplified. Laundering becomes a thing of the past.

Put the Scott Wiper through its paces on your production line. Your local Scott representative or distributor is ready to demonstrate in your plant any time you say. Call him or mail this coupon right away.

SCOTT PAPER COMPANY
Dept. W-2, Chester, Pa.
Please send me more information about Scott "Throw Away" Wipers.

Name_____

Company_____

Position_____

Address_____

FOR MANY JOBS—IN MACHINE TOOLS—ON SURFACE PLATES

Exceptionally Versatile Mounting Holder enables widely varied use.

Hand Movement Always Clockwise, whichever way contact is moved. No reversing latch.

Light Contact Pressure is uniform for both directions of contact point motion.

Unusual Sensitivity gives response to smallest dimensional differences.

WRITE FOR DESCRIPTIVE BULLETIN

MODELS

No. X

Graduated .0001"
Range .008"

Dials Actual Size

No. XB

Both a .0001" and a .001" indicator. Change-over by simple substitution of contact point. Dots represent thousandths when using longer contact point.

Regular and Non-Magnetic Models
All Models Light in Weight & Fully Jeweled

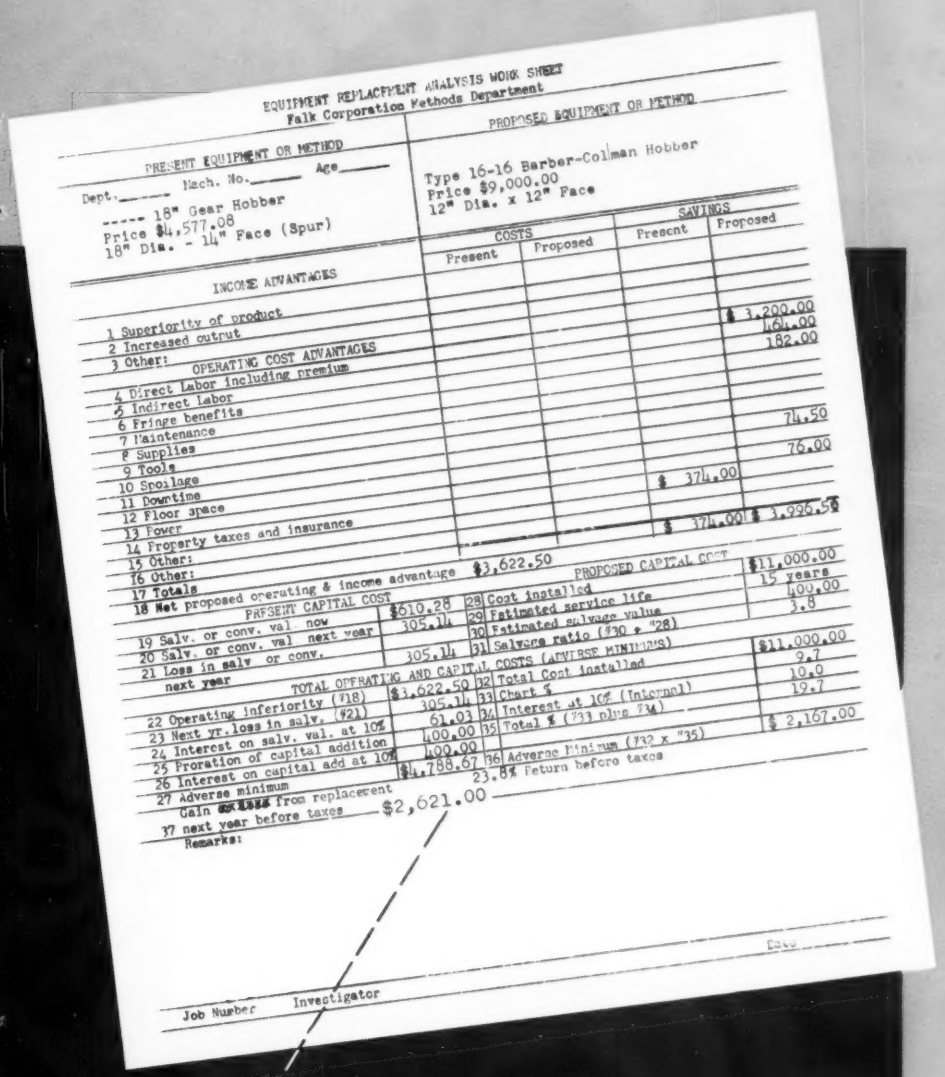
STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

102 PARKER AVE. STANDARD Gages **POUGHKEEPSIE, N. Y.**

For more information fill in page number on Inquiry Card, on page 219

How the FALK CORPORATION *reduces its cost savings opportunities to careful analysis*



EQUIPMENT REPLACEMENT ANALYSIS WORK SHEET
Falk Corporation Methods Department

PRESENT EQUIPMENT OR METHOD

Dept._____ Mach. No._____ Age_____

----- 18" Gear Hobber
Price $4,577.08
18" Dia. - 14" Face (Spur)

PROPOSED EQUIPMENT OR METHOD

Type 16-16 Barber-Colman Hobber
Price $9,000.00
12" Dia. x 12" Face

	COSTS		SAVINGS	
INCOME ADVANTAGES	Present	Proposed	Present	Proposed
1 Superiority of product				
2 Increased output				$ 3,200.00
3 Other:				164.00
OPERATING COST ADVANTAGES				182.00
4 Direct Labor including premium				
5 Indirect Labor				
6 Fringe benefits				
7 Maintenance				74.50
8 Supplies				
9 Tools				76.00
10 Spoilage			$ 374.00	
11 Downtime				
12 Floor space				
13 Power				
14 Property taxes and insurance			$ 374.00	$ 3,996.50
15 Other:				
16 Other:				
17 Totals				
18 Net proposed operating & income advantage	$3,622.50			

PRESENT CAPITAL COST			PROPOSED CAPITAL COST	
19 Salv. or conv. val now	$610.28	28	Cost installed	$11,000.00
20 Salv. or conv. val next year	305.14	29	Estimated service life	15 years
21 Loss in salv or conv. next year	305.14	30	Estimated salvage value	400.00
		31	Salvage ratio (#30 ÷ #28)	3.8
TOTAL OPERATING AND CAPITAL COSTS (ADVERSE MINIMUMS)				
22 Operating inferiority (#18)	$3,622.50	32	Total Cost Installed	$11,000.00
23 Next yr. loss in salv. (#21)	305.14	33	Chart %	9.7
24 Interest on salv. val. at 10%	61.03	34	Interest at 10% (Interpol)	10.0
25 Proration of capital addition	400.00	35	Total % (#33 plus #34)	19.7
26 Interest on capital add at 10%	400.00			
27 Adverse minimum	$4,788.67	36	Adverse Minimum (#32 x #35)	$ 2,167.00
Gain ~~or loss~~ from replacement	23.8% Return before taxes			
37 next year before taxes	$2,621.00			

Remarks:

Date

Job Number Investigator

GAIN from replacement by the Falk Corporation formula is . . . after required interest or return on the new investment . . . after full allowance (by the formula) for future obsolescence of the new equipment.

"Consistent use of this formula shows us which investments will yield the greatest return on our money and enable the committee to plan equipment purchased with confidence."

HAROLD F. FALK
EXECUTIVE VICE PRESIDENT
THE FALK CORPORATION

May 1956

Keep gathering metal-working production ideas . . . be well informed when you replace machine . . . . . .

ROCKFORD INSERT GROUP

Something more

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

than machining...

the most decisive factor of accuracy in a Hendey Tool and Gage-Makers' Lathe

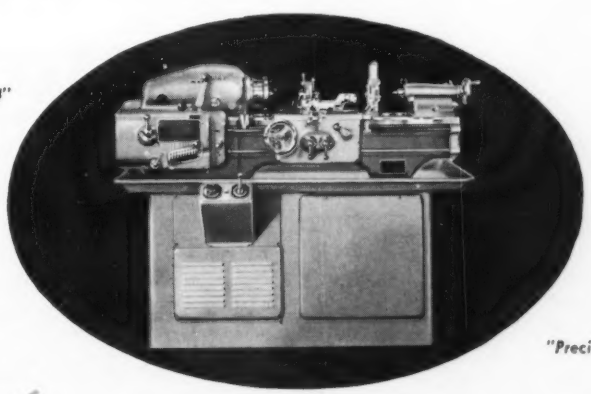
Pictured here is one of the many determining steps in the process of building a toolmakers' machine tool — the point at which craftsmanship takes over after the finest available machines and methods have done their job.

After precision grinding all of the way surfaces on a Hendey 9" Tool and Gage-Makers' Lathe, the operator uses this special fixture to check relative alignment and accuracy. "Tenth" indicators are first set by mounting the fixture on a "master." The "master," itself, has been hand scraped until its ways are within .0002 in. of each other and any other surface. Skillful use of the fixture permits the operator to hold straightness and parallelism of the hardened ways within precision tolerances.

This lathe can be equipped with either a magnetic amplifier or an electronic drive unit. Either of these drives makes turning easier than ever before. They give you a wide range of stepless speeds and close control of speeds, which can be changed smoothly and easily even under load. Production is speeded by a dynamic brake, which allows rapid stopping of the spindle. You can start, stop, and reverse the spindle from pre-set speeds smoothly and quickly . . . and brake maintenance is eliminated.

These are only a few of the reasons this toolroom lathe can help you improve accuracy, increase production, and reduce turning costs. Your Hendey dealer is ready to give you the complete story.

Hendey 9" x 24" Tool and Gage-Makers' Lathe



"Precision with Production"

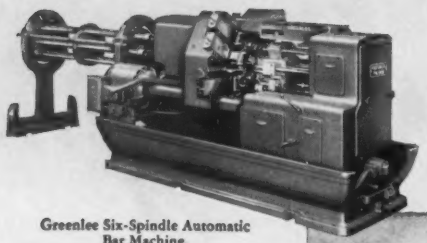
Hendey machine division
BARBER-COLMAN COMPANY
52 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN ®

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

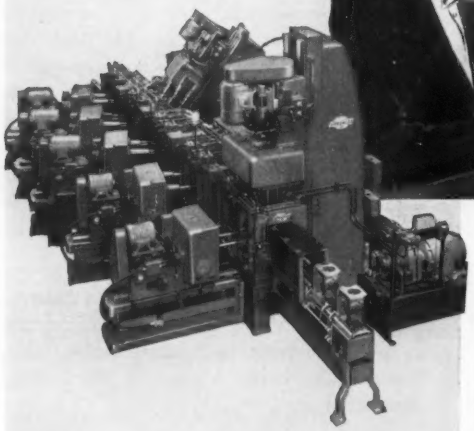
GREENLEE OFFERS

A PROFIT-MAKING INVESTMENT IN HIGH-PRODUCTION MACHINE TOOLS



Greenlee Six-Spindle Automatic Bar Machine.

Greenlee 22-Station Automatic Transfer Machine for machining transmission cases.



Greenlee creative thinking, Greenlee engineering and Greenlee experience combined with that of your own engineers will help you "produce more at lower cost."

Ideas, engineering, experience and facilities of Greenlee Bros. & Co. develop improved methods and machines for greater and greater productivity of future models.

Greenlee's adequate facilities expedite the transition from production ideas to production machines . . . a profit-making investment at work in your plant.

Greenlee 10-Station Automatic Transfer Machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

Write for Further Information

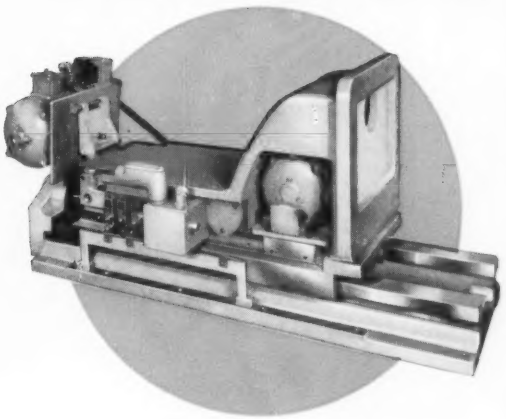
GREENLEE

GREENLEE BROS. & CO.
1867 Mason Ave.
Rockford, Illinois

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

REHNBERG-JACOBSON

NEW SCREW FEED POWER UNITS



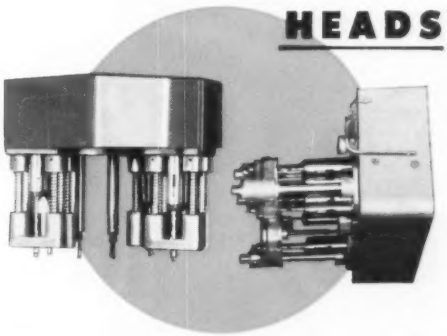
IMMEDIATELY AVAILABLE FROM STOCK

Now you can equip your production machines with powerful, compact, self-contained, ALL MECHANICAL Power Units. The new R-J No. 72 Screw Feed Power Unit shown is immediately available from stock, fully assembled and tested, ready to be installed on your machine. It is rated to take any drive motor up to 25 h.p., and the face plate will accommodate many different types and sizes of single or multiple-spindle heads. Principle of operation involves two-motor differential drive of feed screw and nut to provide a wide range and variety of feeds. Complete automatic controls are included. Details of construction conform to J.I.C. standard. *Write for complete details.*

FOR HIRE:

EXPERIENCE, KNOWLEDGE, AND JUDGEMENT IN THE

DESIGN AND MANUFACTURE OF MULTIPLE-SPINDLE HEADS



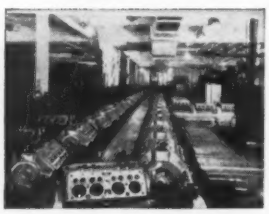
Rehnberg-Jacobson now inaugurates a new service — the design and production of multiple-spindle heads of all kinds. This is a consummation of the experience we have gained in this line in the last 25 years, which we are now making available to everyone in the mass-production industries. Our engineering knowledge, our designing skill, and our manufacturing facilities — heretofore devoted exclusively to special machinery — have now been enlarged and are now available to all users of multiple-spindle heads. *Let one of our experienced field engineers call and discuss your needs.*

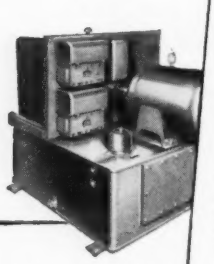
REHNBERG-JACOBSON MANUFACTURING CO.
ROCKFORD, ILLINOIS

REHNBERG R-J JACOBSON

DESIGNERS, ENGINEERS MANUFACTURERS AND PRODUCTION CONSULTANTS

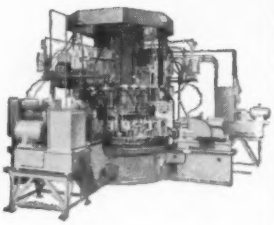
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



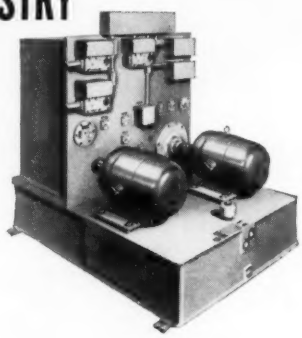


Memo From
John S. Barnes Corporation

Here is the story of a new concept in hydraulic power transmission and control. Maintenance is simplified to cut costs substantially. Send for your copy today!

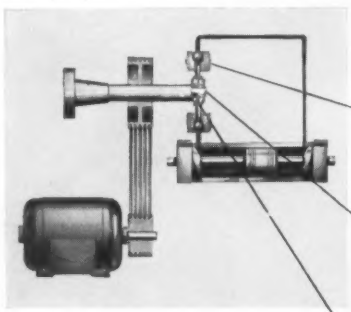


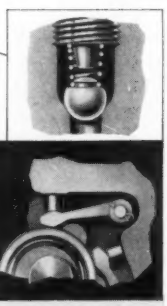
BARNES hydraulics in mass production INDUSTRY



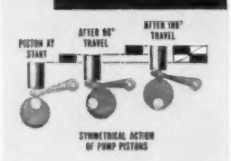
alone

BARNES closed fluid circuit and drive





The Barnes Closed Fluid Circuit consists of a rotary supporting means; a variable displacement pumping arrangement synchronously driven from the rotary means; and a driving arrangement, including means for connecting and disconnecting the rotation of the rotary means, which causes the displacement pump to operate automatically and synchronously with the rotary supporting means.



JOHN S. BARNES CORPORATION / ROCKFORD, ILLINOIS

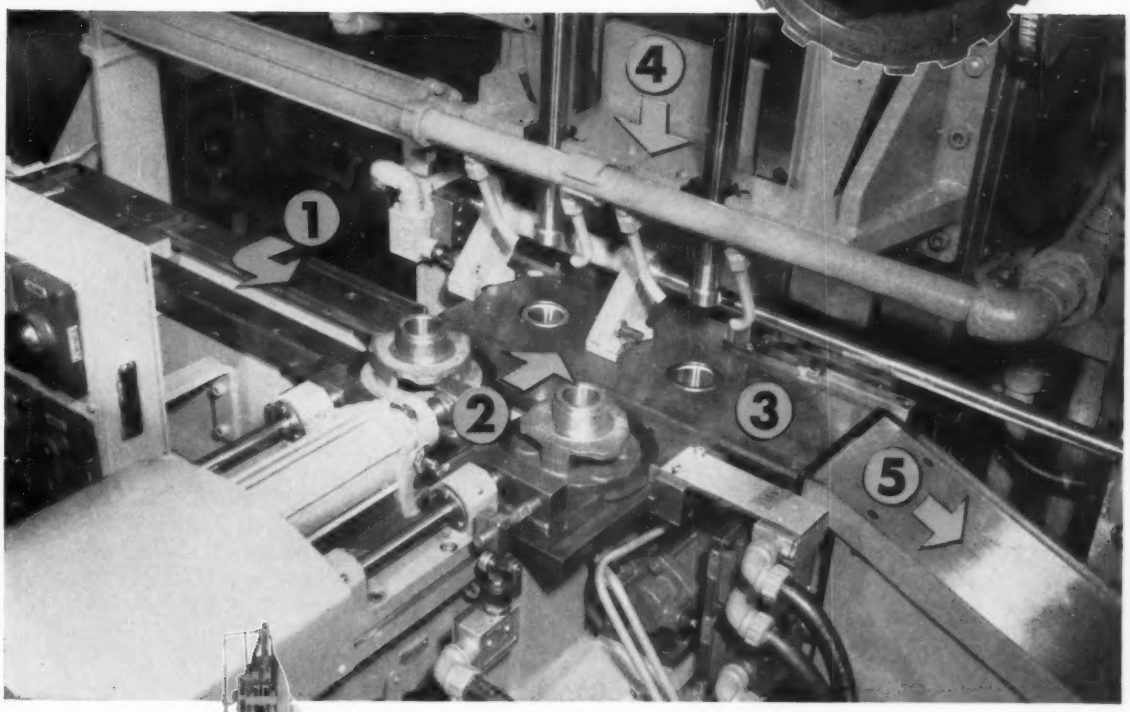
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

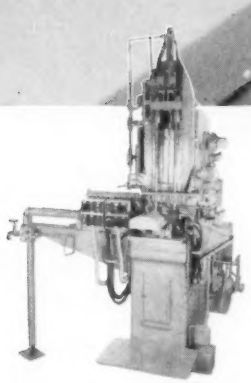
more about **AUTOMATION** by *American* ...

SPLINE BROACHING

of transmission part

MADE FULLY AUTOMATIC





Fully automated broaching by American here results in an output of 380 parts per hour (at 100% efficiency). Regardless of what degree of automation you require, American is prepared to design and build the broaching machine, fixtures and broaches that will fit your production picture best. Write details of your requirements today.

1. Hydraulic fixture, interlocked to the machine cycle, transfers parts laterally, two at a time, from conveyor to position in front of the broaches.
2. Hydraulic pusher carries parts into broaching position.
3. An automatic skid plate then lowers and seats the parts over the thrust bushings.
4. Spline broaches, 36″ long, are pulled down through the two parts, broaching 35 splines in the ID of the hub.
5. As skid plate rises, unseating the parts, hydraulic plunger ejects the parts down inclined chute.

ASK FOR CATALOG 450

AMERICAN *American* BROACH & MACHINE CO.

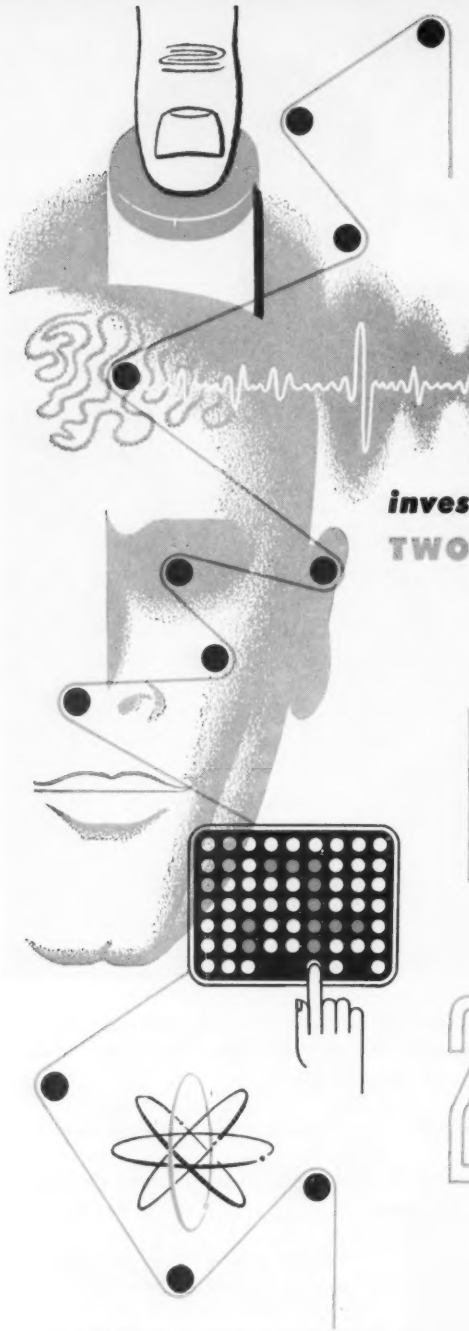
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



need creative automation assistance?

investigate W. F. & JOHN BARNES TWO-FOLD AUTOMATION SERVICE

1 ENGINEERING COMPLETE PRODUCTION-LINE SYSTEMS

Complete service includes planning step-by-step sequence of operations and the individual engineering of processes, methods and equipment to meet your production needs. Barnes' creative engineering, developed over a period of 80 years in designing and building high production machine tools, can be depended upon to provide you with the latest in cost-cutting methods. Our highly versatile engineering staff will work with you as a team to solve problems quickly and efficiently.

2 DESIGNING AND BUILDING SPECIAL UNITS

To meet specific work-handling or processing needs, Barnes' engineers have designed and built special conveyors, turn-over mechanisms, inspection, and assembling equipment to suit either automatic or semi-automatic requirements. Hundreds of units are today profitably serving a wide range of industries. Because electrical, hydraulic, mechanical, tool and fixture engineering is closely coordinated at Barnes under one roof, you save time and eliminate divided responsibility.

Write for Free Literature

Ask for Production Analysis

Find out today why more and more production executives are turning to Barnes for help with their automation problems. Barnes' creative engineering staff will be pleased to analyze your requirements, offer recommendations, and provide you with a cost estimate in a formal proposal, if you desire.

Builders of Better Machines and Equipment since 1872

W. F. & JOHN BARNES

AUTOMATION SECTION

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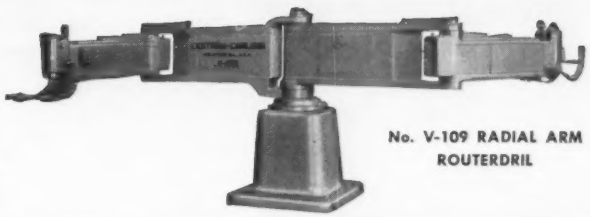
SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

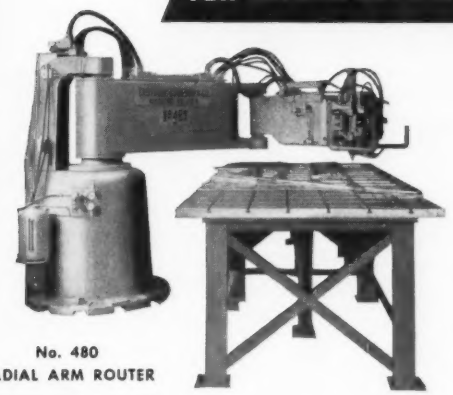
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

EKSTROM, CARLSON MACHINES



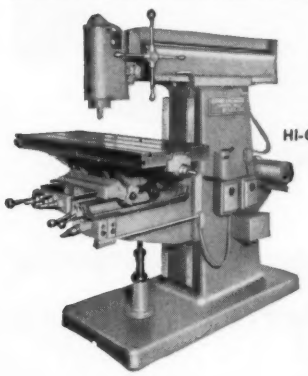
No. V-109 RADIAL ARM ROUTERDRIL

FOR GREATER AIRCRAFT PRODUCTION!

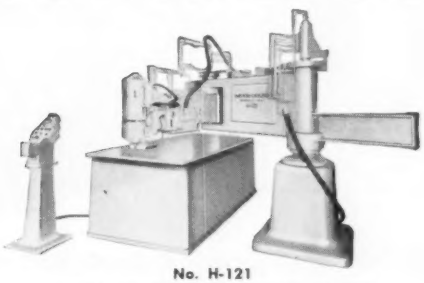


No. 480
RADIAL ARM ROUTER

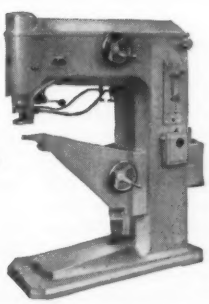
New concepts—new designs—new mechanisms—new highs in production capacities—new standards of performance . . . these outstanding attributes are typical of Ekstrom, Carlson & Co. products for the aircraft industry! Look over the items shown here—pick out those that may fit your present and future plans—then write for free literature giving full and interesting information.



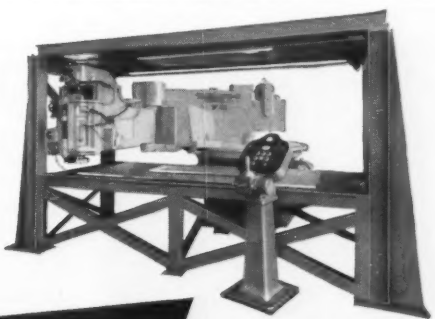
No. 540-HC
HI-CYCLE UNIVERSAL ROUTERMIL



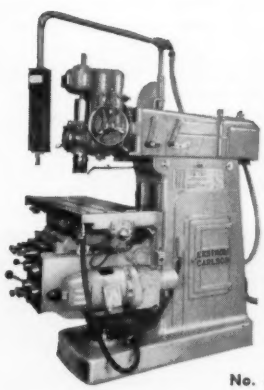
No. H-121
HYDRAULIC-ELECTRIC CONTOUR ROUTER



No. 434-H HORN ROUTER



No. 400
CAV-RO-MIL



No. 5-VA VERTIMIL

by EKSTROM, CARLSON

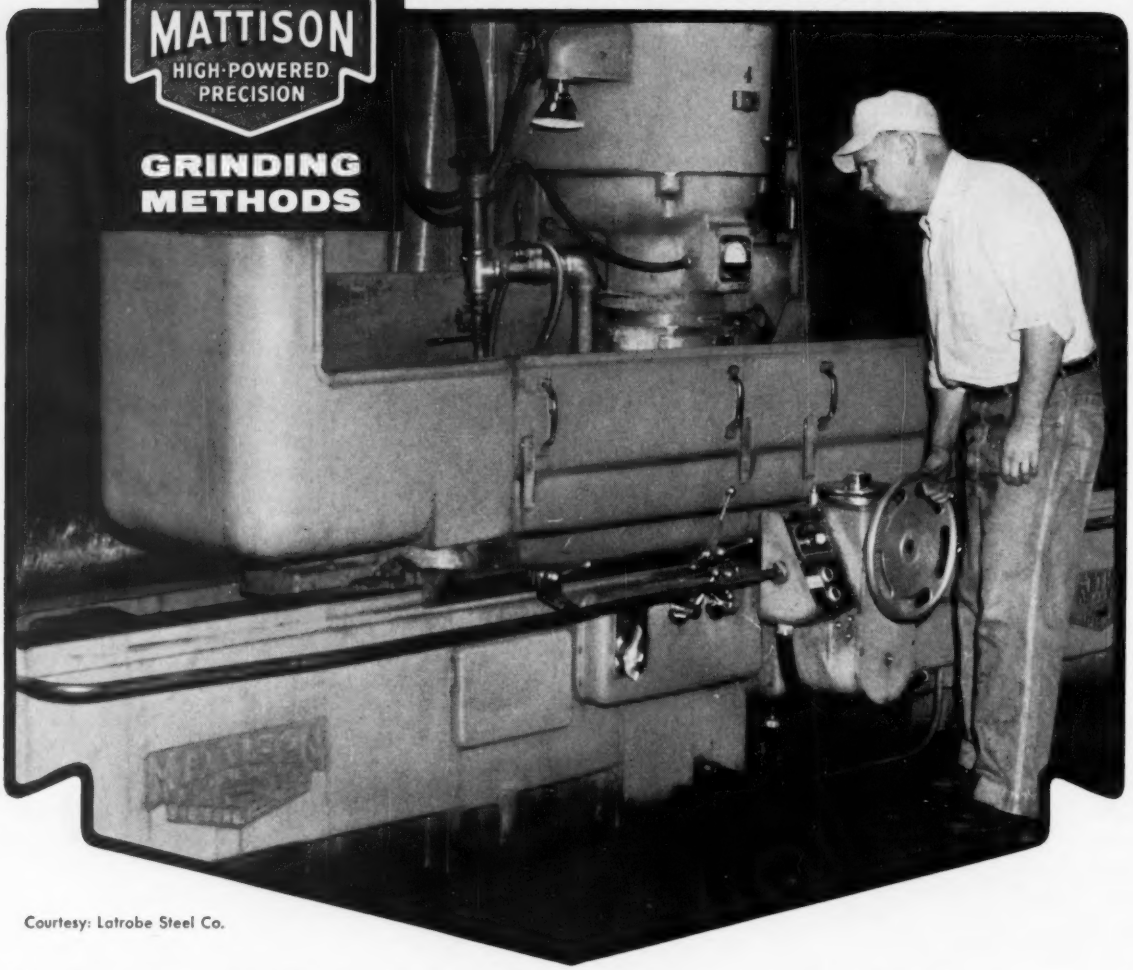
EKSTROM, CARLSON & CO.
Dept. M-4, 1400 Railroad Ave., Rockford, Illinois

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 21—H. S. STEEL TOOL BITS

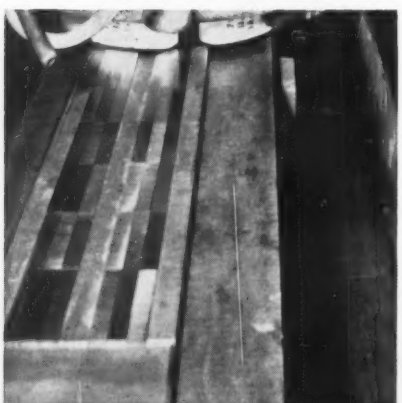
MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS



Courtesy: Latrobe Steel Co.

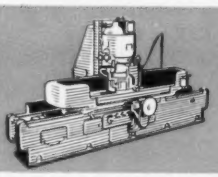
Ease of operation cuts production costs 15 per cent ...high power removes stock 20 per cent faster



High speed tool bits are ground to tolerances of ±.0005 in.—parallelism and flatness held within ±.0005 in. on some jobs.

Production cost savings of 15 per cent through ease of operation are reported by this Mattison user. A Mattison Model 300 Vertical-Spindle Surface Grinder has the power to remove metal 20 per cent faster in the plant of a large manufacturer of tool steel products. This machine consistently meets precision requirements for tolerance and parallelism, and costs very little to maintain.

Accuracy is assured on the Mattison 300 because of its rigid, one-piece column design, high horsepower, and built-in motor whose special shaft is the grinding wheel spindle. This spindle holds its adjustment, yet can be positioned quickly and accurately for the individual job. Exclusive Universal adjustment head slide mounting adds flexibility for handling a greater variety of work. Flat and vee column ways are longer, wider, and thicker, thus preventing any binding of the head slide. Send for Bulletin No. 847.



IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 22—UNIVERSAL JOINT SPIDERS

MATTISON HIGH-POWERED PRECISION GRINDING METHODS

Courtesy:
Mechanics Universal Joint Division

Hold 4 ends square, parallel, and to size on high-production, double-disc grinder!

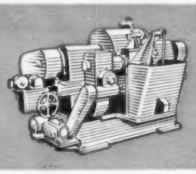
Precision accuracy and low-cost production are made possible by the Mattison Model 221 Double-Spindle Disc Grinder shown above. This job is grinding four ends of large No. 8 universal joint spiders measuring 7¾ in. over ground surfaces, at a high rate of production and with stock removal of .010 in. Opposite ends of these spiders must be ground square with the trunnion diameter and parallel to each other.

Parts are held in "V" fixtures with swiveling "U" blocks, and fed through the Mattison on a rotary-drum type feed mechanism, which is manually loaded and unloaded. This is one of three types of feed mechanisms available: oscillating (reciprocating) feeds, either hand or power operated; rotary fixtures (like the one illustrated); and straight through, for highest production jobs.

High-production work is simplified by features like the exclusive automatic work sizing unit which feeds the grinding wheel heads independently, in order to compensate for wheel wear. Automatic feed increments can be as minute as .0001 in. It's a low-cost method for machining opposed surfaces and thin-walled parts to extremely close tolerances. Write today for Bulletin No. 647-1.

Mattison makes these high-production grinders in five sizes ranging from 10 to 30 in. disc wheel capacity, with 1½ to 50 hp spindle motors.

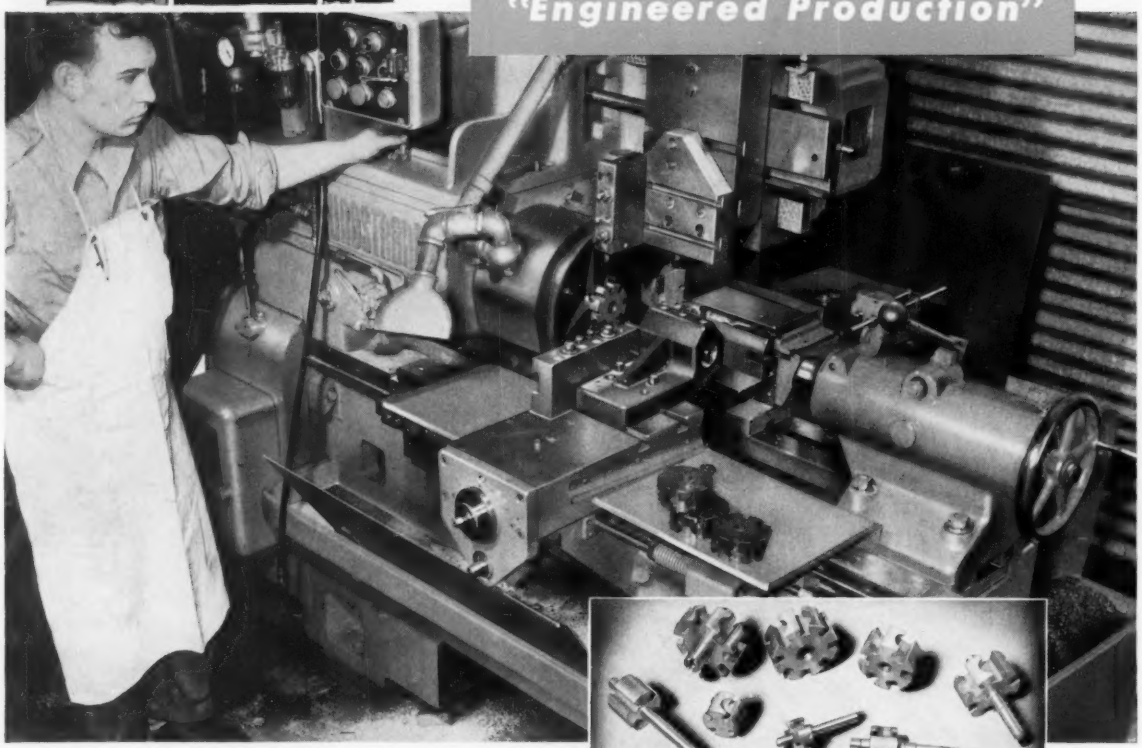
MATTISON MACHINE WORKS
ROCKFORD, ILL. U.S.A.

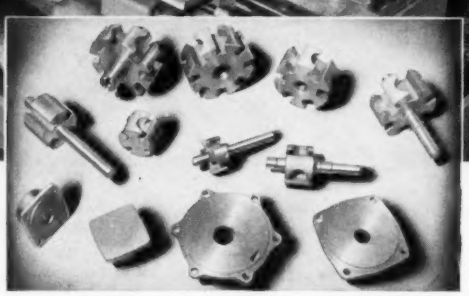


HIGH-POWERED PRECISION SURFACE GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Before You Buy ANY Turning Equipment Check What You Get From SUNDSTRAND "Engineered Production"



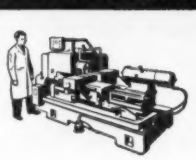


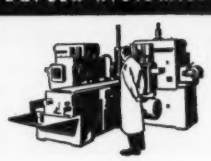
For Instance This Sundstrand Automatic Lathe Increased Production 2½ Times

Here's a small lot turning job done on a Sundstrand Model 8A Automatic Lathe. Pump rotors and covers are turned and faced in lot sizes of 100 to 500 pieces. Previously these parts were run on 3 different conventional turning machines using 3 operations. With this Sundstrand Automatic Lathe, the same amount of work is done 2½ times faster.

SUNDSTRAND *"Engineered Production" Service** *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

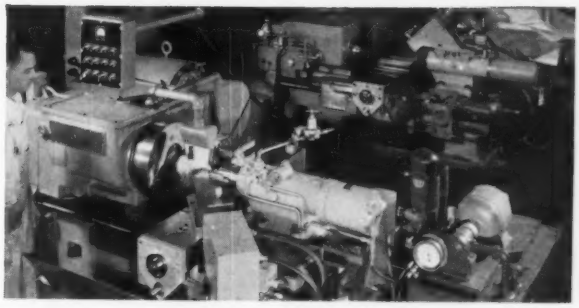




CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

WHY SUNDSTRAND CAN OFFER ECONOMICAL SOLUTIONS TO PRACTICALLY ANY TURNING JOB

Many years of designing machine features to increase production and lower costs on all classes of turning problems has provided Sundstrand with the experience to design and build equipment for practically any turning job. A few of the diversified types of Sundstrand equipment provided for different turning problems are shown on this page.

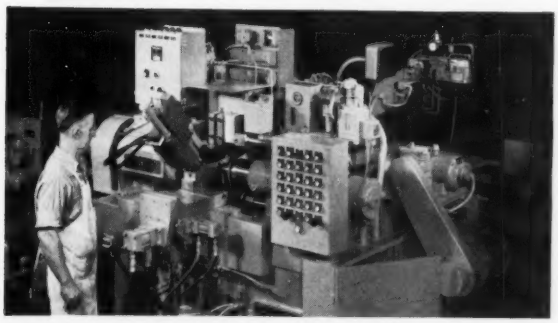


Tracer Turning

For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide mounted to the regular front carriage. With this attachment and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.

Punch Card Control

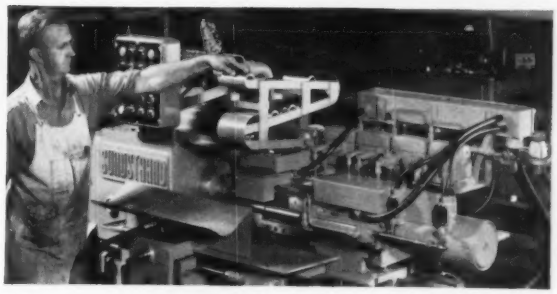
All machine functions of this multi-cycle single point lathe are controlled from punched cards. Set-up time and mechanical skill required to produce parts are reduced to a minimum. Write for folder describing this interesting machine.



Special Turning

This Special Sundstrand Lathe is for automatic turning, reaming and marking rotor assemblies.

Machine has many unusual features such as automatic loading, machining, gaging, unloading and re-setting of tool slides to adjust for tool wear.



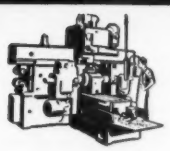
Automatic Loading

Here's one of the many automatic loading and unloading units designed for Sundstrand Automatic Lathes to handle a specific part. Units of this type simplify machine operation and provide a complete automatic cycle for high production.

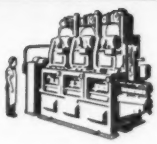
How to get the right machine for your work

Investigate the many services and physical equipment available from Sundstrand "Engineered Production." Call in a Sundstrand engineer, and write for bulletin 667. There is no obligation for this service.

TRIPLEX RIGIDMILS



SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

hydraulic triple circuit

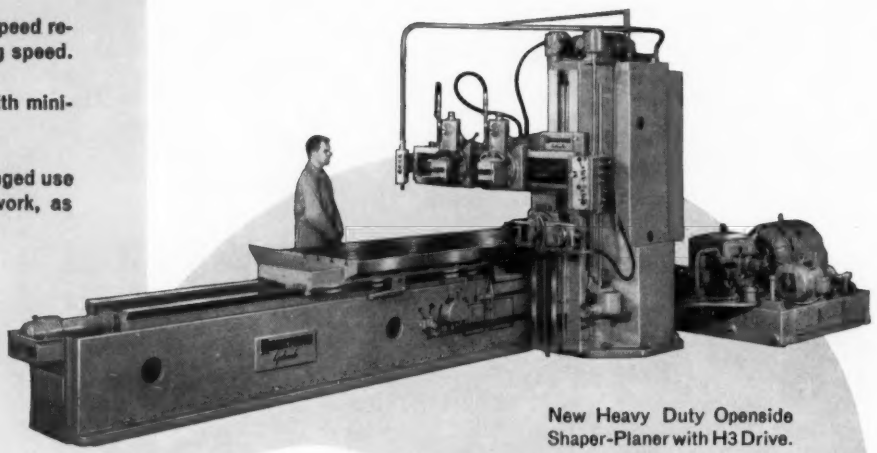
Infinite Speeds from 10 to 300 fpm., stepped through 3 distinct cutting force ranges.

Pendant control of cutting speed selection.

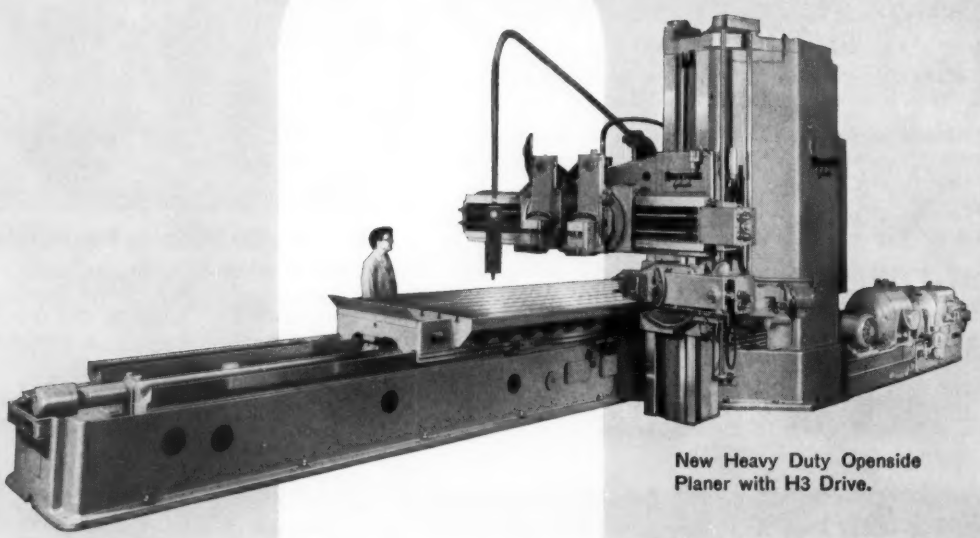
Maximum return speed regardless of cutting speed.

Quick reversals with minimum overtravel.

Suitable for prolonged use on short stroke work, as well as long work.



New Heavy Duty Openside Shaper-Planer with H3 Drive.



New Heavy Duty Openside Planer with H3 Drive.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

provides 3 distinct drives in a single machine!

h3 drive

machines free-cutting metals at high cutting speeds
machines average metals at average cutting speeds
machines tough metals with slow, heavy cuts

Hydraulic drive and feed inherently provide efficiency and ease in planing and shaping metal. Now a new dimension has been added to this proved efficiency and economy of hydraulic power. This exclusive new feature on Rockford Hydraulic Planers is called h3 drive—a triple hydraulic circuit to provide the correct combination of cutting speed and required force to most economically machine materials from the free cutting types to the toughest steels.

Many plants, large and small, who are evaluating their present production equipment will find the h3 drive a significant development in their plans for plant modernization.

We invite you to get full details on this new hydraulic achievement from any Rockford Machine Tool Co. representative, or write directly to us.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

h3 drive

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

it takes top cutter design to get best cutter performance!

BARBER-COLMAN offers

Special Form Development

Special form-relieved cutters often allow several operations to be combined into one. Barber-Colman Engineers are experts in designing special tooth forms on form-relieved cutters for solving specific milling problems.

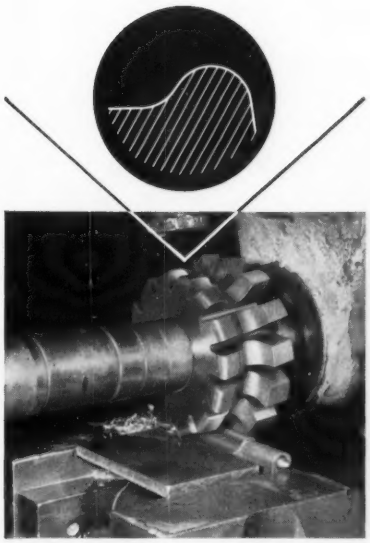
Our cutting tool division has the complete engineering, manufacturing and inspection facilities for making specially-designed form-relieved cutting tools of the finest quality. In addition to designing special forms, our engineers will design into the cutter such special features as axial side clearance, rake angles and helical flutes in any combination to produce maximum cutting efficiency. The best high-speed steel for the specific material to be cut is specified by our experienced engineering staff.

Barber-Colman form-relieved cutters require no "spot sharpening". Accurate face sharpening will maintain the correct form for the life of the cutter. This is true on all cutters including those with axial relief, rake or helical flutes.

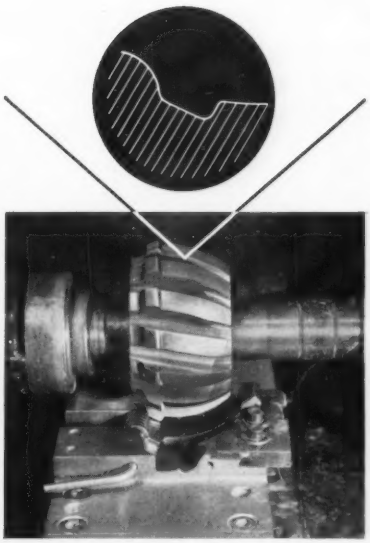
Application of Axial Relief

Surfaces which are in a plane perpendicular to the axis of the cutter, or nearly perpendicular, cannot be milled with a form-relieved cutter unless the cutter teeth are provided with axial side clearance. Barber-Colman can solve this problem by making the cutter with axial relief in one or both directions so that several cuts can be combined into a single milling operation. These applications show the proper use of axial clearance and helical flutes.

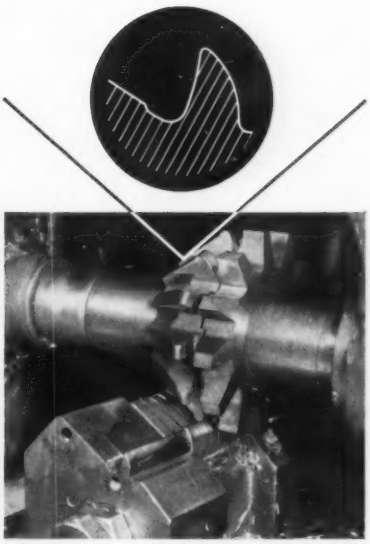
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



The form on this part has one side which is nearly perpendicular to the axis of the cutter, requiring a cutter with axial relief as well as radial relief. Both the axial and radial relief are formed onto the cutter tooth at the same time, and they are both applied to the complete tooth form. Consequently, the faces of the teeth can be sharpened without changing the tooth form. Helical flutes are provided to produce a shearing cut for improved finish and cutter life.



The form on this cutter is provided with both radial and axial relief because one small section of the form is nearly perpendicular to the cutter axis. Without axial relief, the perpendicular portion of the form would wear rapidly because of insufficient clearance. However, since the entire form has ample clearance behind the cutting edge, cutter life is greatly improved. Helical flutes eliminate any chatter during the cutting operation.



The workpiece in this application is tipped at an angle so that there is no undercut portion in relation to the axis of the cutter. However, in its cutting position, both sides of the form are nearly perpendicular to the cutter axis. The cutter is a two-piece interlocking type with axial relief in one direction on one side of the form, and in the other direction on the other side of the form. As the cutter is sharpened the form spreads apart, but the correct shape of the form is maintained. The proper dimensional relationship between the form is maintained by simply grinding the spacer between the two sections to the proper thickness.

These are only a few examples of the many special cutter problems passing through our Engineering Department daily. We welcome the opportunity to work with you in solving your production problems, and we invite you to send us part prints. Get top cutting efficiency through top cutter design.

BARBER-COLMAN COMPANY

825 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

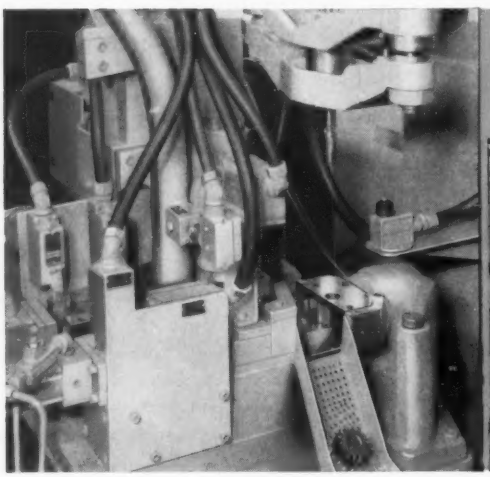
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

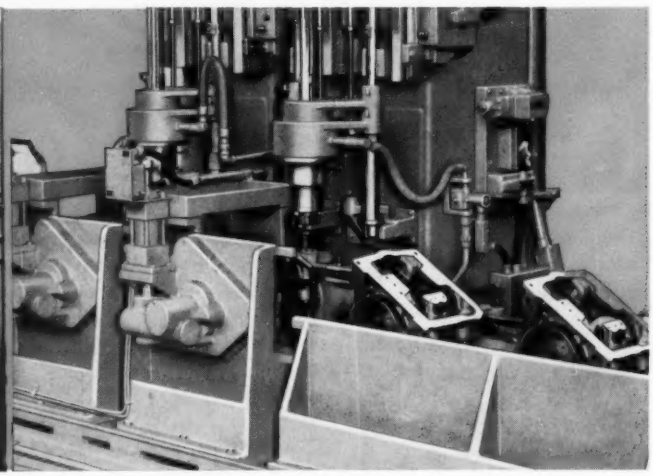
automated honing

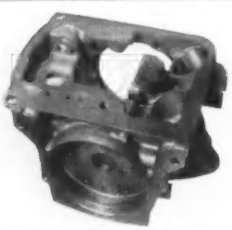
for connecting rods, gear bores, or other parts requiring high speed automatic production

Full Automation

Loading
Clamping
Honing
Sizing
Unclamping
Unloading
Gaging and Selecting







BarnesdriL Honing Machines for specific production applications are arranged with fully automatic loading and processing cycle. Parts with oversize bores unsuited for honing are automatically rejected, and selected parts advanced to the honing position. Parts are honed and sized to preselected tolerances, and finish, and then discharged automatically.

All steps in the cycle are under cycle-control. Stock is removed, surface selectively finished, precision bore-to-bore sizing guaranteed, all within the automatic cycle. BarnesdriL exclusive control over abrasive wear eliminates size differences bore-to-bore. Honing stone design provides cutting support right up to the cutting edge, for longer life and free cutting action.

Consult a BarnesdriL engineer for application of automatic controlled sizing and finishing for your high production parts.

DETROIT OFFICE — 3419 South Telegraph Road, Dearborn, Michigan

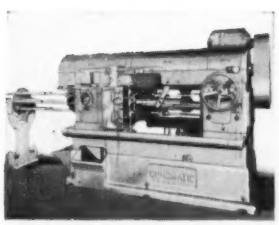
BARNES DRILL CO.

820 CHESTNUT STREET ● ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

New "triple duty" Danly Press

-Draws-Blanks-Forms

FINGERTIP GEAR CHANGE AND EXTRA LONG SHUT HEIGHT ADJUSTMENT PERMIT QUICK SHIFT FROM BLANKING TO DRAWING OPERATIONS...SOLVE SHORT-RUN STAMPING PROBLEM FOR LEADING HEATING UNIT MANUFACTURER

A leading manufacturer of home heating units needed a great variety of stampings . . . large blanks, drawn parts and deep formed pieces. Stamping these parts on a relatively short-run production basis would tie up entire lines of presses . . . unless one press could do the job. A specially designed Danly Press that blanks, draws and forms . . . and converts to these three types of operations quickly and easily . . . solved the problem.

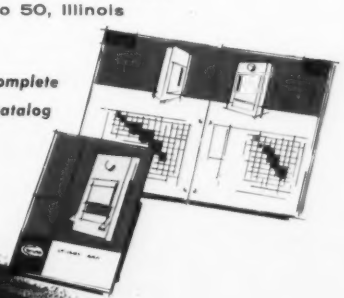
Two unusual features give this "triple duty" Danly Press its unusual adaptability. First, the 24″ stroke with a 30″ range of shut height adjustment accommodates shallow blanking operations or deep dies for drawing and forming. Second, special gearing controlled from the master panel is easily changed to permit stroking at two speeds – one ideal for drawing, the other faster for blanking. Speed selection is controlled from the operator's station. The result: a "triple duty" Danly Press suitable for producing a tremendous variety of big stampings.

If your operation requires short production runs of a great many different kinds of stampings, Danly can help solve your production problem, conserve workhours and manpower. Danly presses will make your pressroom more efficient for your specific type of work. *Talk with a Danly engineer – soon!*

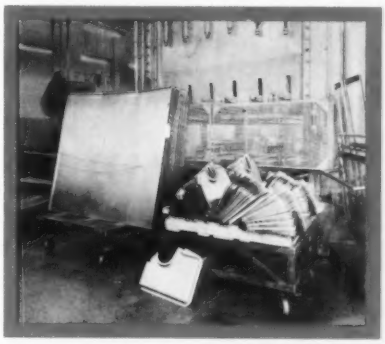
DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue
Chicago 50, Illinois

Write for complete single action straight side press catalog



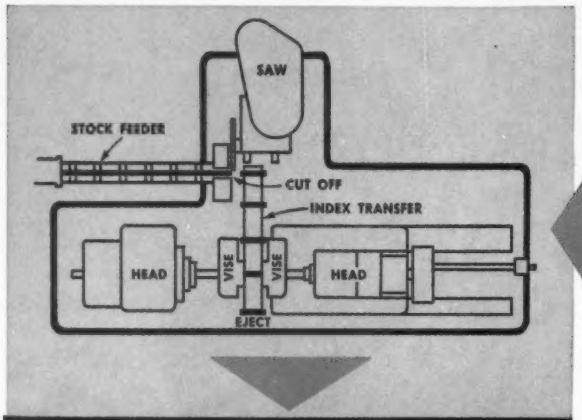
Stocks of parts produced on the specially built "triple duty" Danly Press. Note variety and size, particularly depth of form on V-shape stampings.



The contrast in these parts typifies the production problem solved by the Danly "triple duty" press.

An array of stampings like this would normally require several types of presses.

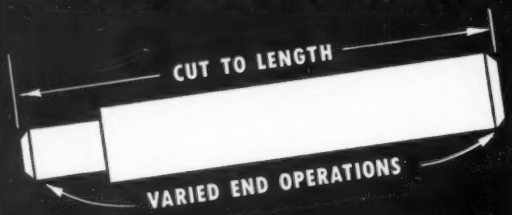
DANLY®



HOT BED OF ACTIVITY

Motch & Merryweather's new transfer machine widens the horizon for the simultaneous double-end machining of bar stock or tubing. Combined with cut-off to accurate length are: centering, chamfering, turning, drilling, or boring. Box mill turning is performed along with center drilling and chamfering. From stock pile to discharge, all operations can be fully automated. For the quickest answer to speed your stock processing, send us your part drawing.

Simultaneous
STOCK CUT OFF and DOUBLE END MACHINING



M & M No. 00-TB transfer machine. Two models handle lengths up to 60" and diameters to 4".

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

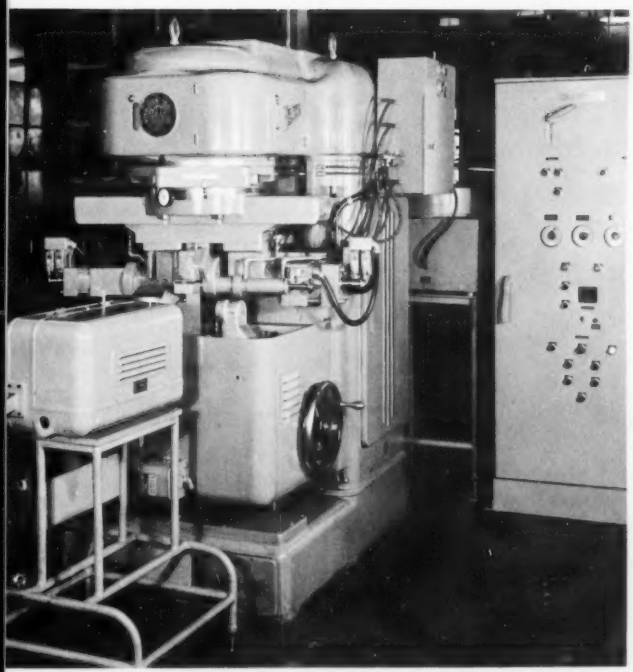
CLEVELAND 13, OHIO

BUILDERS OF AUTOMATIC PRECISION CUT-OFF, MILLING, AND SPECIAL MACHINERY

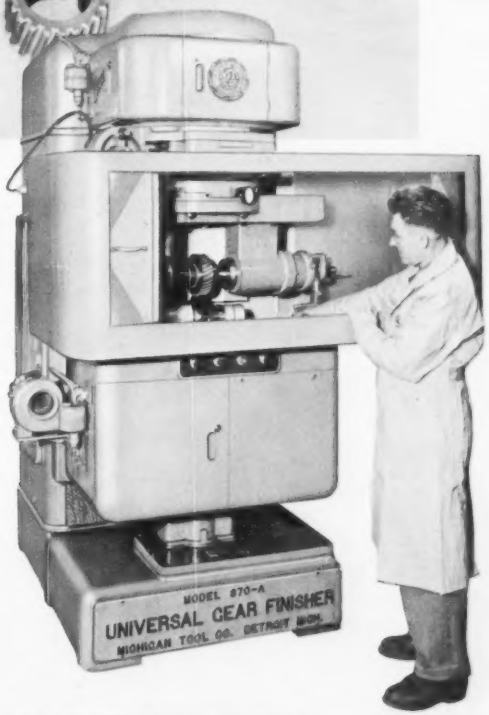
For more information fill in page number on Inquiry Card, on page 219

This Month's

GEAR PIX



LATEST GEAR-O-MATION® equipped Michigan 870 gear shaver finishes 18-tooth automotive pinions at 260 per hour. Features are: hopper feed, automatic load and unload, pneumatic headstock and tailstock, 3-way classifier with automatic feedback maintaining correct center distance, desired accuracy and production requirements preset on control panel, more accurate gears produced.



MACHINE TOOL BUILDER shaves a wide variety of gears (a few are shown) on this Michigan 870-A gear finisher. Underpass is used for shoulder cluster gears, while the transverse method, in combination with crowning, is favored for shaving wide face spur and helical gears. This 870-A has an 18-inch capacity, which covers practically all requirements for this Illinois firm.

MICHIGAN TOOL COMPANY

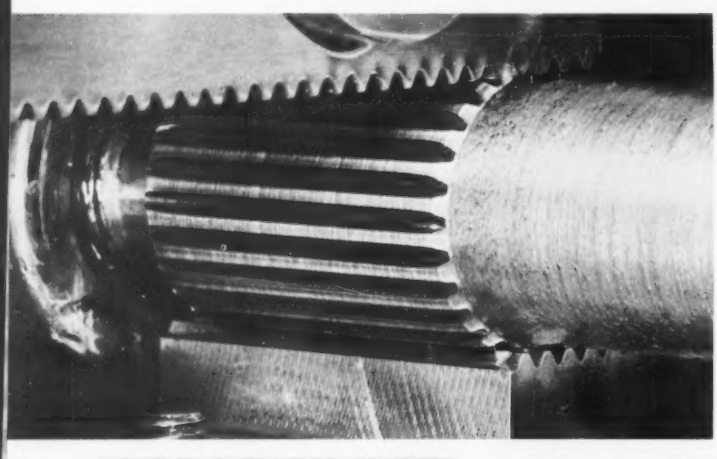
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

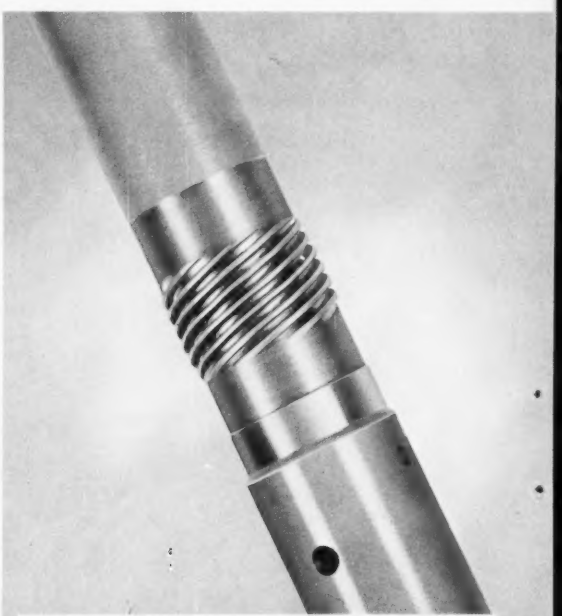
This Month's

GEAR PIX

EVERY 14½ SECONDS ROTO-FLO spline rollers in tandem are cold-forming splines at two different locations on each automotive axle shaft. GEAR-O-MATION equipment loads shafts automatically, transfers from one machine to the other, returns double-splined shafts to the operator.



ROTO-FLO FORMED SPLINES, just coming off the forming racks. Actual forming process takes 4 or 5 seconds—floor to floor time is 10 to 15 seconds. Cumulative spacing error is less than .0015 inch—compare it to your present spline manufacturing.

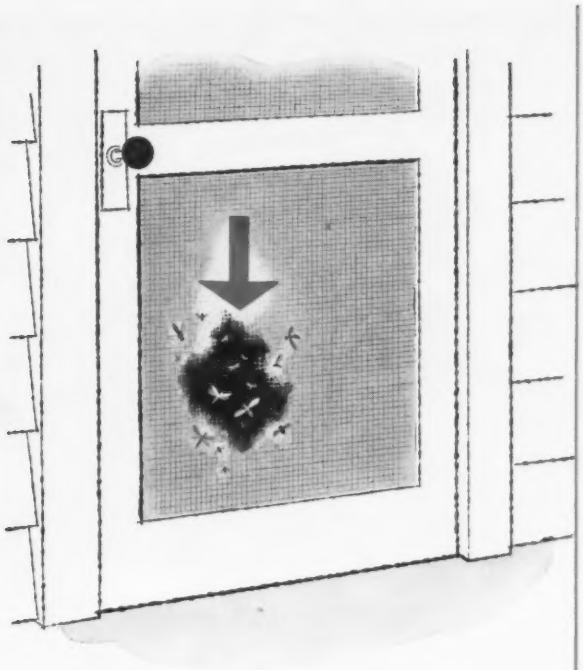


COLD-FORMED HELICAL TEETH (by ROTO-FLO process), as shown here, have a very high degree of accuracy. Note the sharp, square corners at the top of the teeth, the 3 to 6 micro-inch finish on the tooth form. Compare the few seconds required to produce parts like these with your present production on similar parts.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.



a hole here is a nuisance...

a hole here is convenient

Crucible Hollow Tool Steels eliminate the nuisance of drilling, boring, cutting-off or rough-facing of ring-shaped, tubular or bored tool steel parts. They save you money, too, by reducing machine time and scrap losses.

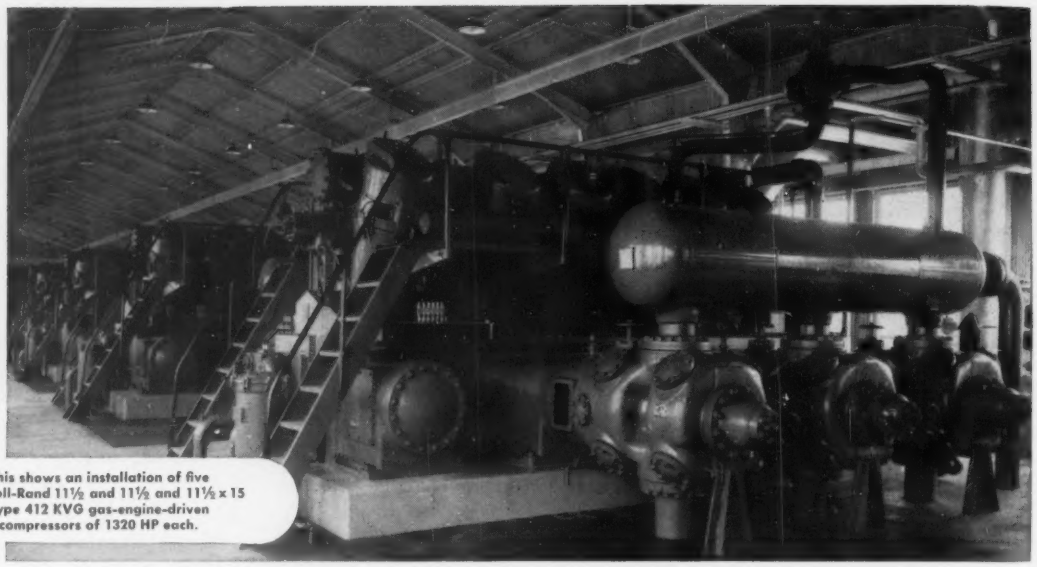
Crucible Hollow Tool Steels are produced in all of the famous Crucible tool steel grades . . . in bars or saw cut lengths to meet your needs. And they're available in almost any combination of O.D. and I.D. sizes. You can get these five grades "off the shelf" from your local Crucible warehouse: KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot work.

See how Crucible Hollow Tool Steel Bars will save you hours of shop time. Call your Crucible representative. *Crucible Steel Company of America, The Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.*

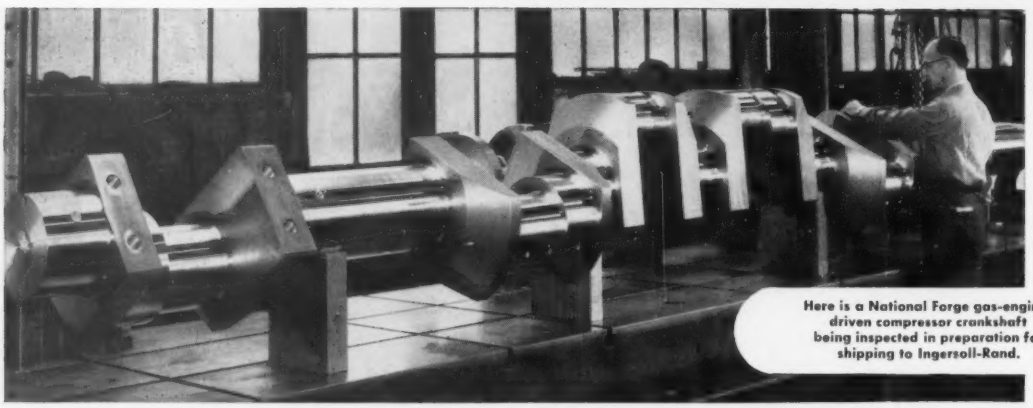
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.



This shows an installation of five Ingersoll-Rand 11½ and 11½ x 15 Type 412 KVG gas-engine-driven compressors of 1320 HP each.



Here is a National Forge gas-engine-driven compressor crankshaft being inspected in preparation for shipping to Ingersoll-Rand.

INGERSOLL-RAND USE NATIONAL FORGE CRANKSHAFTS IN THEIR POWERFUL COMPRESSORS

It takes a lot of muscle to move gases over the long distances of America's pipe line network and these large Ingersoll-Rand gas-engine compressors have what it takes. Each component that goes into them must perform its function with complete reliability.

National Forge takes pride in being an Ingersoll-Rand supplier. The crankshaft shown here originated with National Forge basic electric steel and was turned out in successive steps of forging, rough machining, heat treating and finish machining. In every step of the process, continuous checks were made to maintain the close control necessary to final performance.

Your forgings receive the same meticulous care when they are National Forged and you may be sure that you receive the finest quality obtainable.

NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY, PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 219

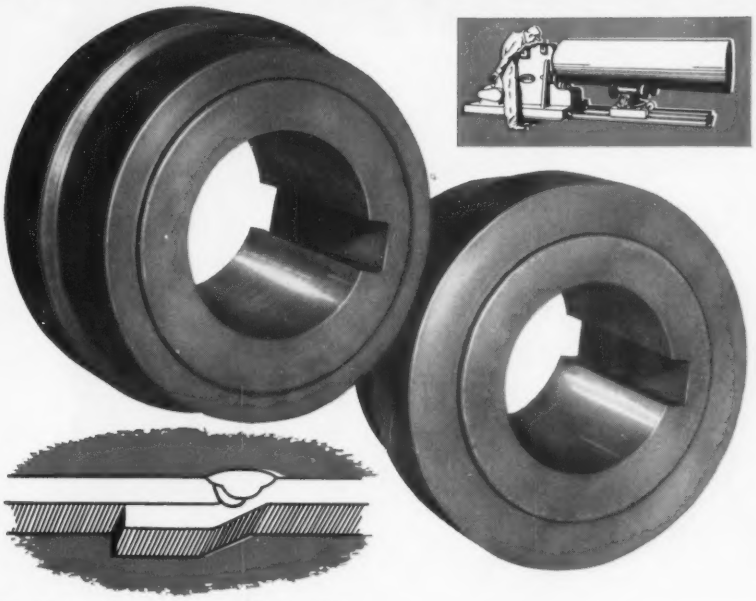
Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Hollow-Bar Dies Prove Economical for Forming Offset Joggle Joints



The Webb Corporation, Webb City, Mo., manufacturers of industrial and mining machinery, had been fabricating a special grade of alloy steel to make roller-type forming dies, similar to those shown above. The dies formed joggle joints on shell ends, in a machine which produces an offset flange around the ends of cylinders, as a backing for automatic welding.

"Now there's a place," we pointed out, "where we believe BTR Hollow-Bar tool steel can effect a saving. It comes with the hole already formed in the steel, so right at the start you save a lot of machining. And as for wear and dependability, we can let BTR Hollow-Bar speak for itself."

The change was made, BTR (Bethlehem Tool Room) Hollow-Bar being put to work forming ASTM-A212 steel plate, ½ in. thick. At Webb they are pleased with the results — not only the saving in machining, but with Hollow-Bar's wear-resistance and ease of heat-treatment.

BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning, by which hammer-forged round bars are cored out in the center, then rough-turned on the outside.

Hollow-Bar comes ready to go, virtually as soon as you receive it. There's no lost time waiting for forged rings or discs. Nor is there any need for drilling, rough-boring, rough-facing or rough-turning.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

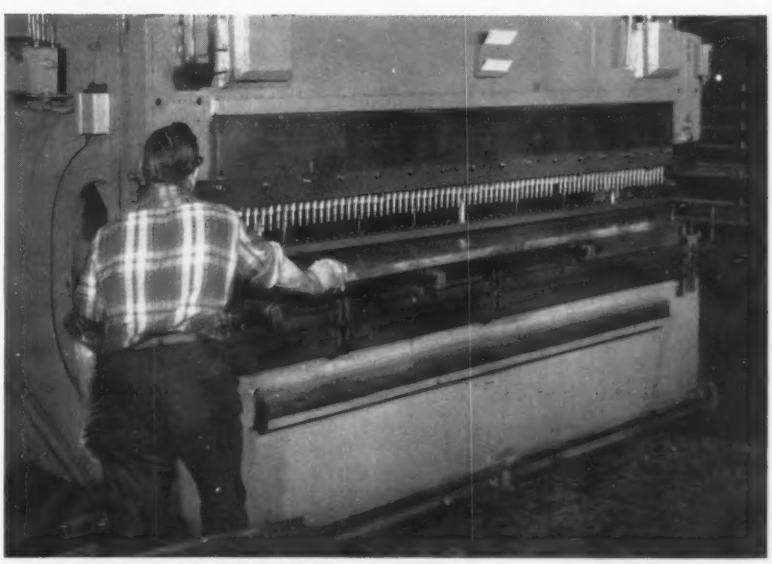
3 Steps to Take When Tools Don't Harden

When tools do not harden properly in heat-treatment, it's a good idea to check first for mixed steel. This can readily be done either by means of spark-testing, or by experimentally hardening another piece of the same stock.

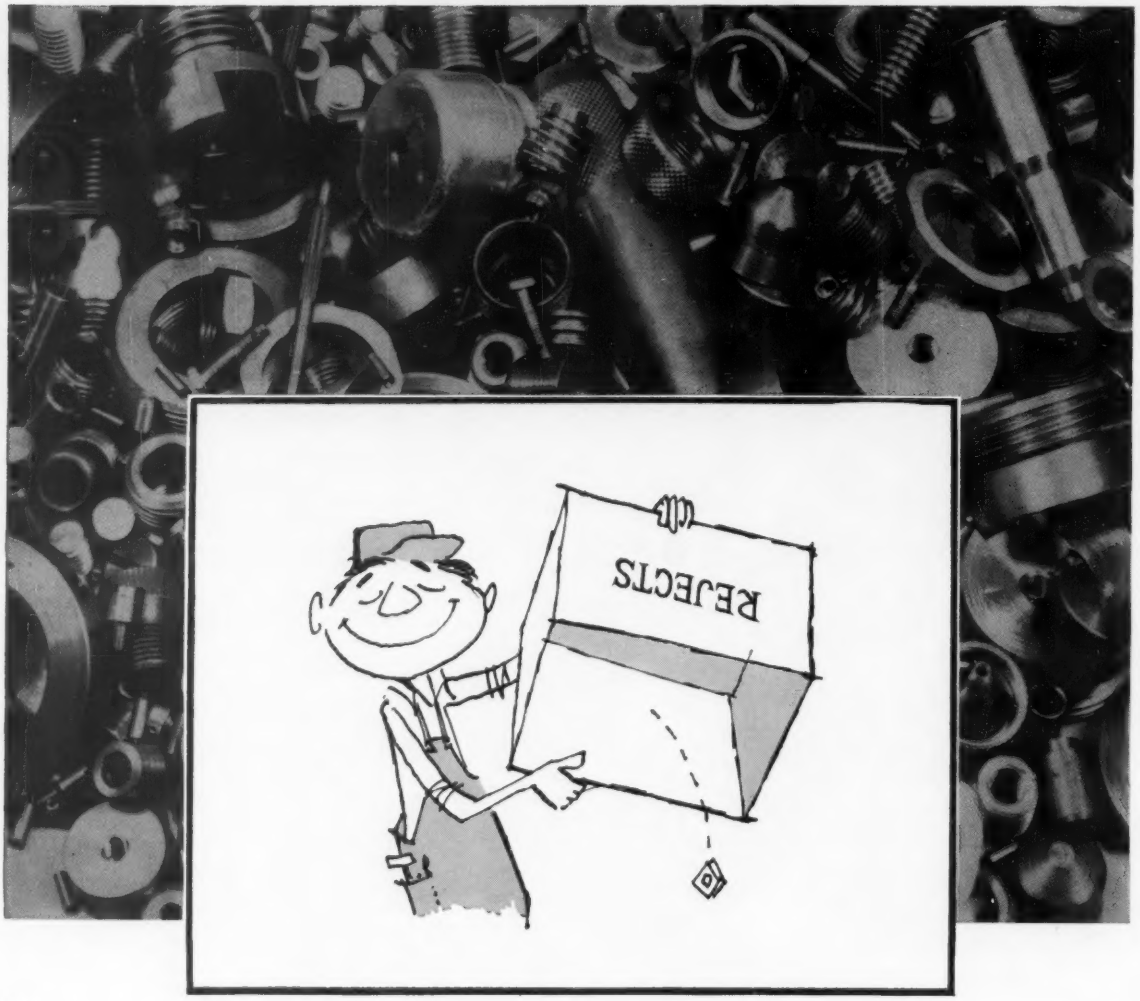
Next, recheck the hardness. Has the tool been ground below any possible decarburization which may have developed during heat-treatment? Was enough material removed from the original bar stock to get below decarburization? Has the hardness tester been checked against standards?

Third, investigate the heat-treatment practice. The most frequent causes of low hardness are: (1) the use of too low a quenching temperature, or too short a hold at correct temperature, (2) retained austenite, due either to an excessively high quenching temperature or an excessively high carbon carburized case, and (3) too slow a quench.

Though it pays to do the job correctly the first time, trouble-shooting of improper hardening has its place.



Steady Punching With Brake Die This picture, taken at Lyon Metal Products, Inc., York, Pa., shows Bethlehem Brake Die used as a punching die for ¼-in. diam holes in a steel-shelving panel. Brake Die provides good service in applications of this type because of its outstanding wear-resistance and toughness, and resistance to impact.



Rejections dwindle to a new low when you start running on USS Free-Machining MX Steel.

It's a fact. Ever since this faster-cutting bar stock was developed, and in every shop where MX has been put to work, not only have more parts per hour been produced but they have been *better* parts. Better in finish, accurate in dimension, lower in cost—and with fewer rejects to cut into profits.

These highly desirable results are obtained with USS MX primarily because of its superior machinability, and also because this steel is consistently uniform in shipment after shipment. Uniform in cutting characteristics. Uniform in its composition and grain size. Uniform in freedom from defects and injurious imperfections.

Give USS MX a trial in your shop and watch production go up and costs come down. The performance of MX has been so universally superior that we feel sure that it will cut the cost of any part you now machine from ordinary screw stock.

USS Free-Machining MX is produced in both Bessemer and Open Hearth grades and is available in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output... longer tool life... fewer rejects
—when you do the job with free-machining

MX

USS

UNITED STATES STEEL

For more information fill in page number on Inquiry Card, on page 219

"IT'S BETTER IF IT CONTAINS MOLY"

Moly carburizing steels with 0.5% Mo are a natural for components like this automotive ring-gear and pinion. They have outstanding properties that suit them to the demands of gearing and similar applications, such as, superior case hardness, low distortion and good machinability. Many features of these new carburizing steels are discussed in a recent technical article. For a reprint, write Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y., Dept. 13.

Molybdenum Carburizing Steels

MOLYBDENUM OFFERS THE ECONOMICAL KEY TO PERFORMANCE

Over the years, molybdenum carburizing steels have proved their merits in scores of applications and at every level of production.

Design engineers know moly steels for their uniform hardenability, toughness and wear resistance.

Production men know that moly steels are easy to heat treat, easy to machine.

Management knows that moly steels mean economy in fabrication, high performance in a wide range of end products.

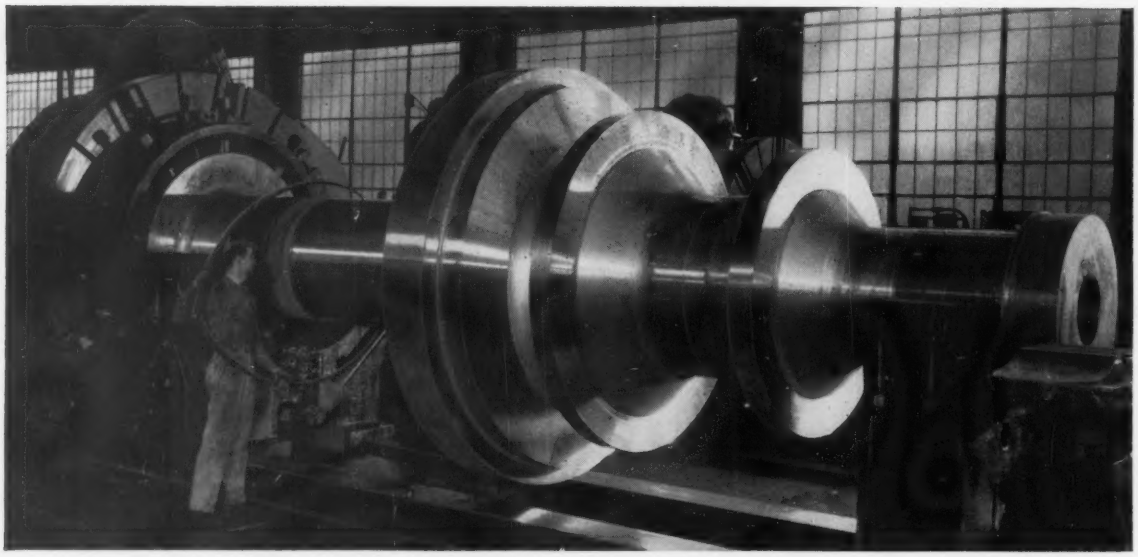
Standard molybdenum carburizing steels are widely available. Higher moly analyses may be ordered in heat lots from a number of leading suppliers.

CLIMAX MOLYBDENUM

Use the Moly Key to better carburizing steels

- High case hardness
- Wide choice of hardenability
- Easy to heat treat
- Low distortion
- Good machinability
- Good wear resistance

Their job is to help make power



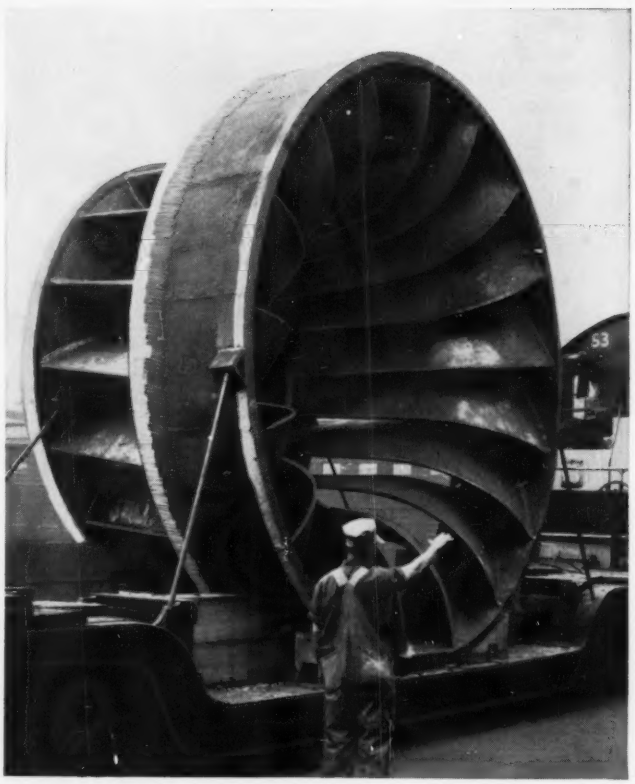
Here are two giants of steel that were recently created in the Bethlehem shops. Though dissimilar in shape and dimensions, their basic business is the same—to help make power for the country's growing needs.

That big shaft will do an important job in a Western hydroelectric project. A forging made of carbon-vanadium steel, it weighs approximately 61 tons. Its overall length exceeds 22 ft.

The vaned runner in the other illustration is a foundry product. Like the forging, it's a whopper, weighing 49 tons. It too is earmarked for a hydroelectric installation.

Through the years Bethlehem has furnished many large components for use in power production. Countless Bethlehem forgings and castings are also in service in other industries. Some of these pieces are huge—but please remember, we're equally well equipped to turn out small items, too. For instance, some of the drop forgings we make are small enough to tuck into your vest pocket.

When your needs call for either forgings or castings, we hope you'll get in touch with us. Whether your order runs to tonnage or is small, we'll give it all we've got!



BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Here's the best shortcut in the field of organic finishing

One operation usually removes paint, rust and oil at the same time.

One tank of Oakite Rustripper frequently does all these jobs: (1) strip rejects and conveyor hooks; (2) pickle rusted stock; (3) prepare reconditioned products for refinishing operations.

One tank may eliminate many tanks used in ordinary cycles.

Here's the best shortcut in the field of electroplating

One operation usually removes rust and oil at the same time. One alkaline tank may remove oxides, drawing compound residues and other stubborn soils . . . even strip zinc from rejects and racks.

Sensational Oakite Rustripper frequently eliminates acid pickling and its troublesome after-effects: (1) hydrogen embrittlement; and (2) smut that must be removed by electrocleaning or hand brushing.

FREE Our illustrated booklet tells how this amazing cleaner - stripper - deruster offers tremendous possibilities for saving minutes, hours, dimes, dollars. Write or send coupon for your copy.

FREE Our illustrated booklet tells how this shortcut may save you time and money—in tank lines, in automatic platers, in barrel lines—by saving equipment, floor space, acids, water, steam and electricity. Write or send coupon for your copy.

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SPECIALIZED INDUSTRIAL CLEANING
MATERIALS · METHODS · SERVICE
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26 Rector St., New York 6, N. Y.

Send me a free copy of the booklet checked:

☐ *"Here's the best shortcut in the field of organic finishing"*
☐ *"Here's the best shortcut in the field of electroplating"*

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COMPANY_____

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An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate

BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

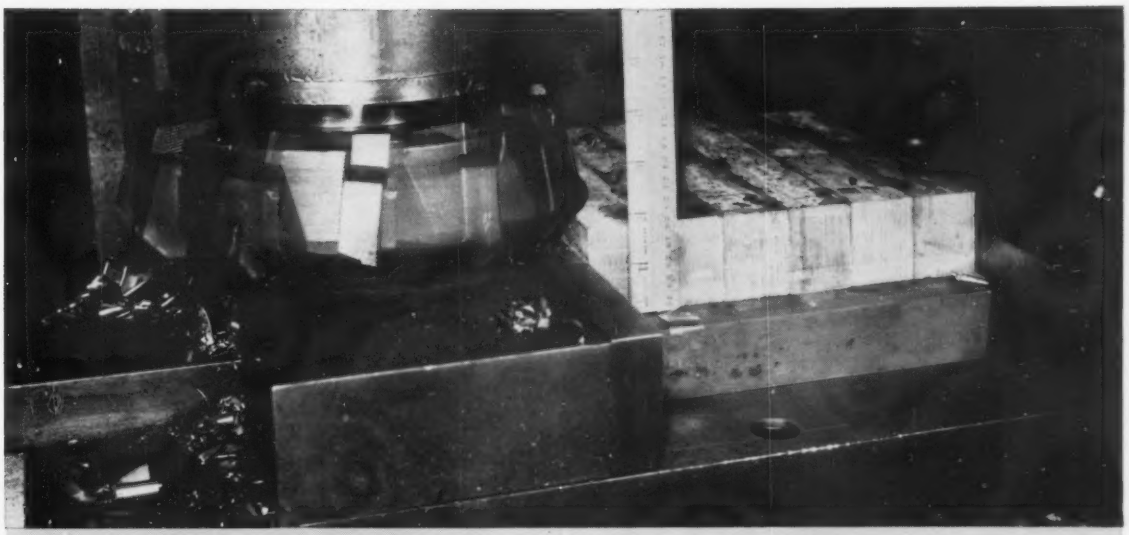
CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

CARMET®

STEEL-CUTTING CARBIDES

1 INCREASE PRODUCTION 2 GIVE UP TO 50% LONGER LIFE



DETAILS OF JOB ILLUSTRATED

Machine	Sundstrand Rigid Mill
Cutter Size	10" Diameter
No. of Teeth	12
Carbide Inserts (grade)	Carmet CA-610
Rate of Travel	400 S.F.P.M.
Table Speed	10 in. per minute
Depth of Cut	½ inch
Material	1095 Cold Drawn Shank Steel, 200 Brinell

READY FOR YOU

Complete Technical and Shop Data on the Carmet "CA-600 Series" of special steel-cutting Carbides

Write for Your Copy

ADDRESS DEPT. M-77

Here's something *special* for you: the new Carmet steel-cutting grades of carbide, called the "CA-600 Series." One of the grades is shown above in a milling operation—a tough job where the major requirement was continuous production. Cutters equipped with Carmet CA-610 inserts not only increased the production of the machine on this job, but actually gave 50% longer life than the comparable cutting materials previously used.

These heavy-duty CA-600 Carmet grades (premium products in performance, *at no premium in price*) have been thoroughly job-proved in the field. They're available to fit *your* steel-cutting requirements . . . *let us arrange a demonstration of their ability to save time and money for you.* Get in touch with your nearest A-L representative or distributor, or address *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.*

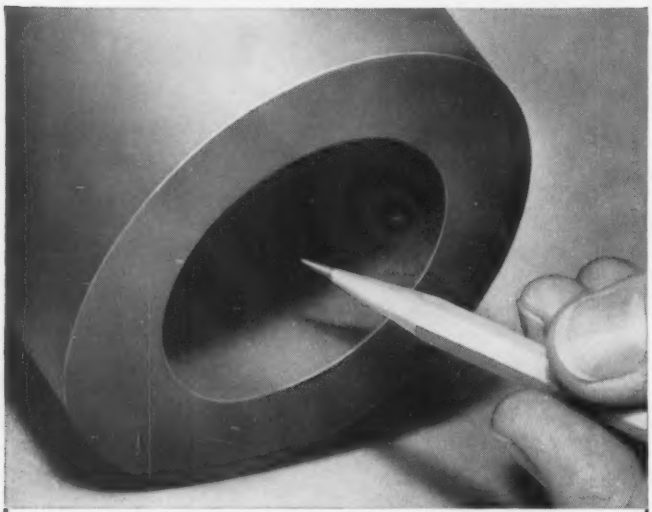
For ALL your CARBIDE needs, call

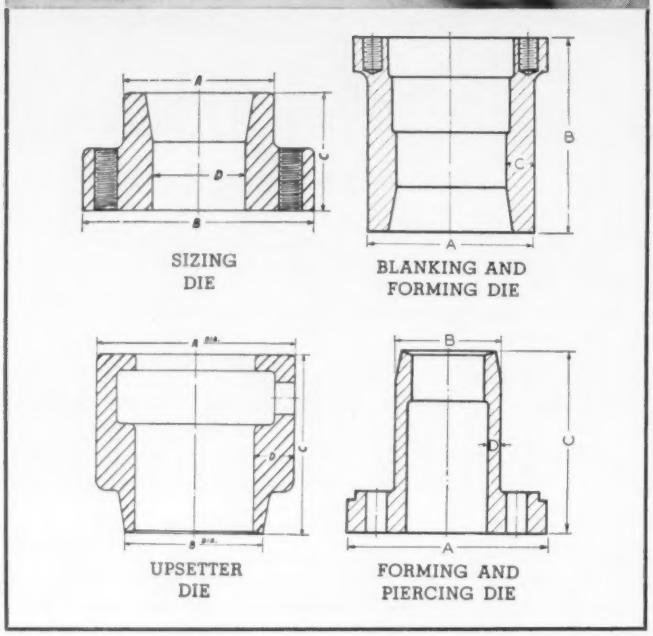
Allegheny Ludlum®

WSW 5544 B

AL FINE TOOL STEELS SINCE 1854

SPEED PRODUCTION, CUT WASTE WHEN MAKING RING-SHAPED TOOL STEEL PARTS





New Graph-Mo® Hollow-Bar eliminates drilling, machines 30% faster

IF you make ring-shaped tool steel parts, you'll find that you can speed production, cut waste, and save steel by using Graph-Mo® Hollow-Bar. That's because Graph-Mo Hollow-Bar comes with the hole already in it. There's no drilling. You start with finish boring.

And with Graph-Mo Hollow-Bar you get the combination of proved advantages that have made Graph-Mo one of the most popular tool steels: excellent machinability, exceptional wearability, unsurpassed stability.

Actual tests prove that Graph-Mo machines 30% faster than other tool steels. That's because Graph-Mo has free graphite in its structure. And this free graphite gives Graph-Mo less tendency to pick up, scuff, and gall.

Graph-Mo's amazing wear resistance stems from a combination of graphite and diamond-hard carbides. Reports from users indicate that Graph-Mo outwears other tool steels on an average of three to one.

Graph-Mo also is the most stable tool steel ever made. A master plug gage made from this steel showed less than ten millionths of an inch dimensional change after 12 years in use. And Graph-Mo responds uniformly to heat treatment, too.

Makers of ring-shaped tool steel parts may obtain Graph-Mo Hollow-Bar in sizes from 4 to 16 inches O.D. with various wall thicknesses.

To learn more about Graph-Mo Hollow-Bar, and its application to your problems, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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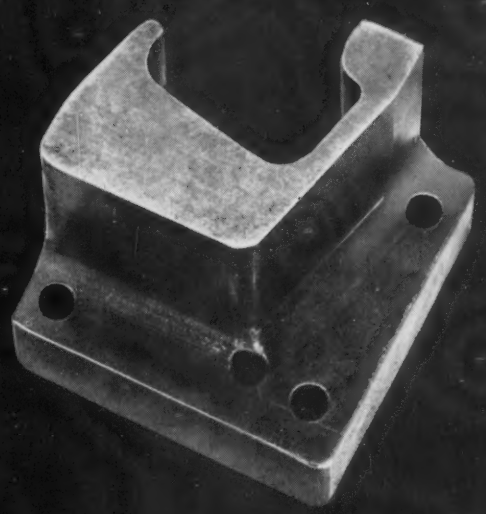
FIELD REPORT: NO. 90



WHICH DIE STEEL WOULD YOU USE HERE to get this punch out of hardening in one piece?

This punch blanks automotive stampings from SAE 1010 strip, .062" thick. It is so unbalanced in design that safety in hardening is vital in the die steel used. Since the punch is shear fitted to the die section before heat treating, accuracy in hardening is equally important. The punch is hardened to Rockwell C-61/62. All the steels tried either broke or changed size excessively.

If the decision were squarely in your lap, which die steel would you be willing to recommend?

Here's how the manufacturer solved the problem, as recorded in a Field Report from our customer: The Carpenter Matched Set Method showed that Carpenter VEGA (Air-Tough) Die Steel had the hardening safety and accuracy plus toughness demanded by the job. The punches are now coming through heat treatment "right on the nose," and production between grinds has jumped from about 10,000 to 50,000 parts. Further, the heat treater says VEGA is the easiest air-hardening steel he has ever worked with.

When the decision is up to you, rely on Carpenter for *dependable* results. For fast attention to your orders, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor, today.

Your toolroom can use Carpenter Matched Tool and Die Steels to:

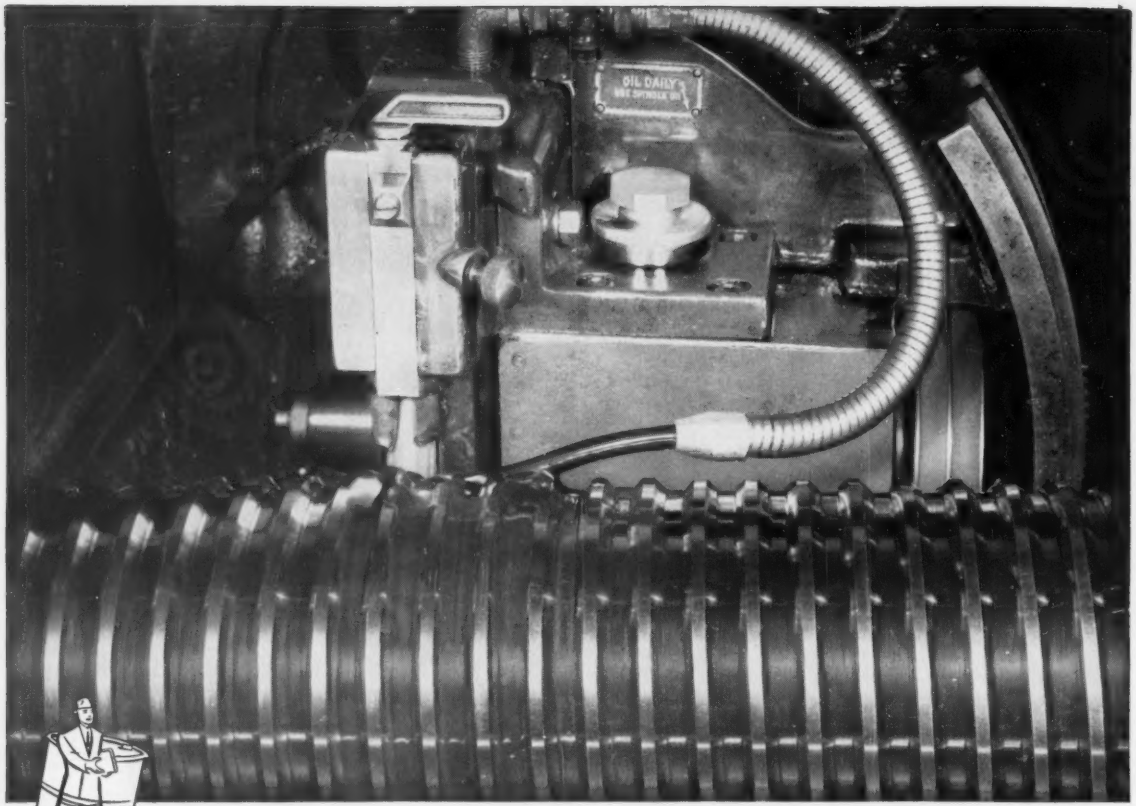
- Reduce hardening hazards
- Minimize machine downtime
- Boost output per grind
- Improve product quality

Visit Our Booth
A.S.T.E. INDUSTRIAL EXPOSITION
INTERNATIONAL AMPHITHEATRE
CHICAGO ..... MARCH 19-23, 1956

Carpenter STEEL

Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks — The Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Export Address: Port Washington, N. Y.—"CARSTEELCO"



Ask "the Man in the Barrel" to tell you how . . .

A Grinding Oil can *make* or *break* precision grinding jobs!

If you're using *just a coolant* or any oil that happens to be handy for those precision grinding jobs . . . it's costing you money!

A grinding oil can make or break a precision grinding job such as thread grinding, gear grinding and many types of form grinding. Grinding oils are usually classified as "hard-acting" or "soft-acting" depending on how they affect grinding wheel hardness. Grinding oil characteristics must be closely co-ordinated with wheel characteristics, speeds, feeds, and material machinability and hardness to obtain maximum performance.

When form grinding low hardness materials, where wheel form is important, a "hard-acting" oil helps to maintain proper wheel form by making the wheel act harder. As a result, greater wheel life is obtained and more accurate parts are produced.

When a high hardness material is being ground there is a tendency for the wheel to load-up and glaze. Such a condition is the cause of burnt work surfaces and heat checks, and is often encountered when grinding taps, gauges and other hardened parts. A "soft-acting" grinding oil will make the wheel act softer, opening up the wheel and exposing new abrasive grains to do the work.

Stuart's complete line of grinding oils have been chemically balanced and scientifically tested to meet the demands of various types of precision grinding operations. "The Man in the Barrel," your trained Stuart Representative, will be happy to assist you in selecting the proper grinding oil for your particular needs. Ask to have him call . . . and ask for a Stuart's Precision Grinding Oil Bulletin, too.

D. A. STUART OIL COMPANY, LTD.
2739 S. Troy Street, Chicago 23, Illinois

More than a "Coolant" is Needed

Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, Philadelphia and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

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star performer

...and among high speed steels

REX is the leader

Crucible REX® high speed steel has been the winner in shop tests for more than fifty years. *And now REX is even better than ever!* For Crucible research and experience has led to improved manufacturing techniques that mean higher quality – greater uniformity.

Prove the superiority of REX for yourself – on your next job. Check it for size, structure, response to heat treatment, all-around tool performance. Then you'll know why REX has always been the *standard by which other high speed steels are compared.*

REX is immediately available at all of Crucible's convenient warehouses – or through prompt mill delivery. For a list of available data on REX and other Crucible *special steels,* write for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

For more information fill in page number on Inquiry Card, on page 219

time tested designing with **MADISON-KIPP** zinc and aluminum die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

We will be pleased to review your blue prints.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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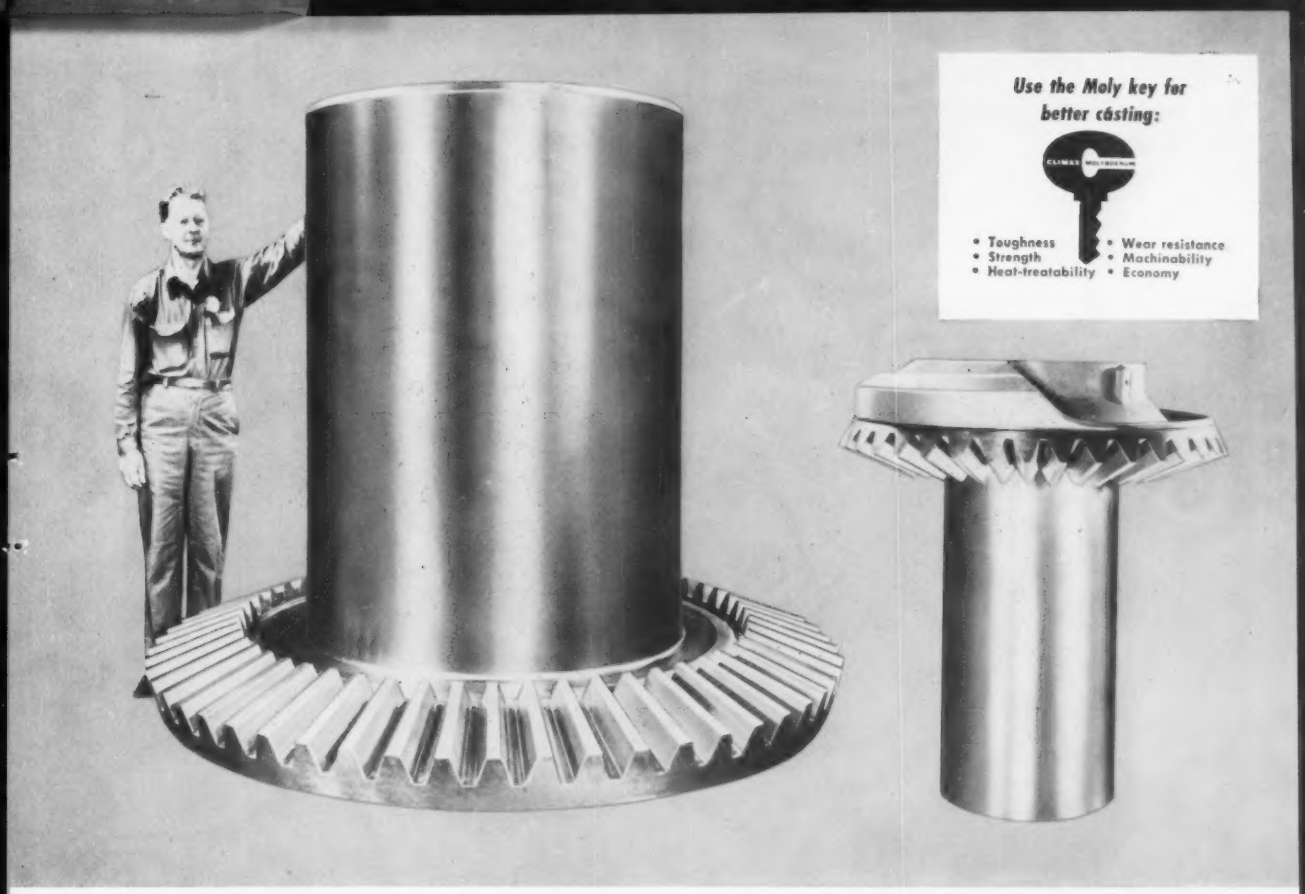
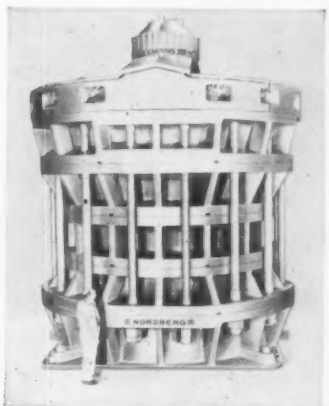


Heavy duty ore crushing machinery is subjected to severe operating conditions. To meet these strenuous requirements the gears shown are made from heat treated low-alloy manganese-*Molybdenum* steel castings. At left: a Symons Gyratory Crusher gear; right: a Symons Cone Crusher gear. Built by Nordberg Mfg. Co.

Cast Manganese Moly Steel contributes strength and toughness to Crushers built by Nordberg

"Where high strength and toughness are prime considerations," says Howard Zoerb, Consulting Engineer of the Nordberg Crusher Division, "molybdenum bearing steels are specified. This is true of the heavy duty parts of Symons® Crushers, built by Nordberg. These steels have contributed to the Nordberg reputation as producers of dependable, heavy duty crushing machinery."

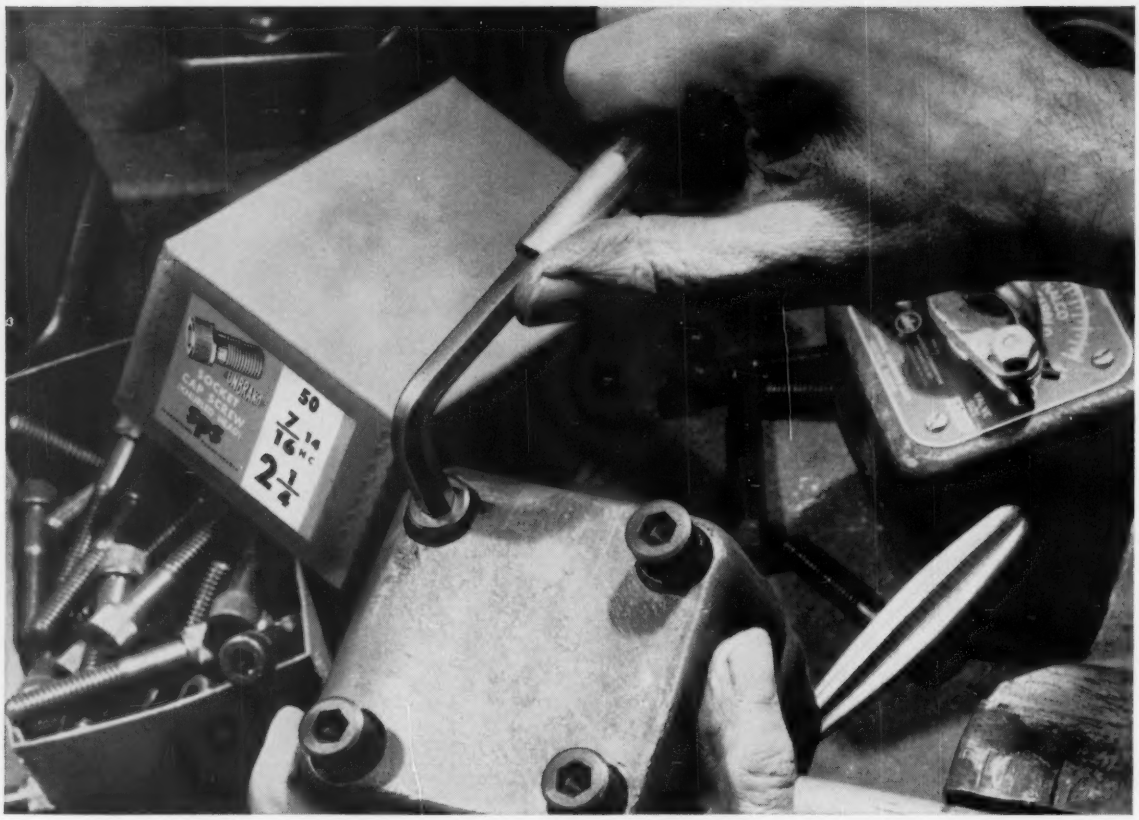
Technical assistance is available to foundries on alloying problems. Please address inquiries on your foundry letterhead to: Climax Molybdenum Company, Department MF 13, 500 Fifth Avenue, New York 36, New York.



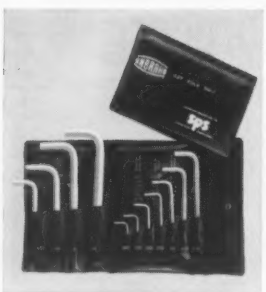
The Symons Cone Crusher is a product of Nordberg Manufacturing Company.

CLIMAX MOLYBDENUM

For more information fill in page number on Inquiry Card, on page 219



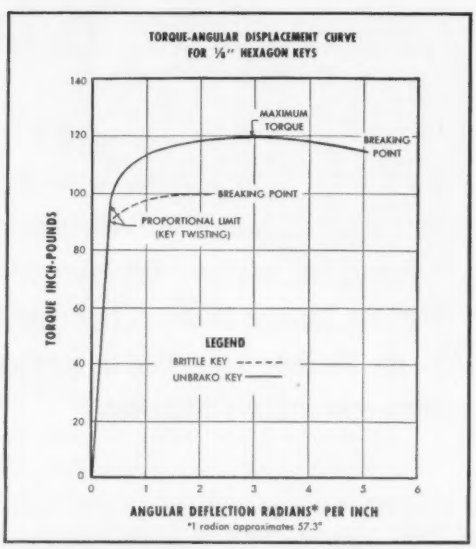
Tighten socket screws tighter, more safely with High-Titan UNBRAKO hex keys



High-Titan UNBRAKO socket screw keys are stronger than ordinary keys. They are made of selected, accurately sized hex stock, with carefully formed 90° bends that won't break. The ends are cut square to engage sockets full depth for highest tightening power. These keys are heat treated uniformly to give hardness and ductility clear through without brittleness or decarburization.

All this results in many advantages. You can torque up a screw tighter with an UNBRAKO than any other key. Performance is consistent—you can apply the same tightening torque every time. Screw sockets won't ream, and the keys won't wear excessively. If you should apply too much torque, a High-Titan would break, but shear off clean and even with the top of the socket—not at the bend—and without leaving jagged exposed edges to gash your hands.

One High-Titan hex key is included with each standard package of UNBRAKO socket screws. High-Titans are also available as sets in convenient, durable plastic key folds, and in bulk. Your authorized industrial distributor carries them in stock. See him today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.



THESE CURVES SHOW THE DIFFERENCE between an UNBRAKO hex key and an ordinary key. The UNBRAKO withstands more tightening torque, twists through 180° without breaking, then shears off even with the top of the screw socket. Ordinary keys snap off suddenly at the bend.

UNBRAKO® SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

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John Topman, Factory Superintendent, says:

"I LIKE GEOMETRICS because . . .

. . . I'm interested in production schedules, costs and quality control. GEOMETRIC tools suit me on all counts, they're dependable, economical and, of course, you can't beat them for accuracy. Just look at the workmanship in this collapsing tap!

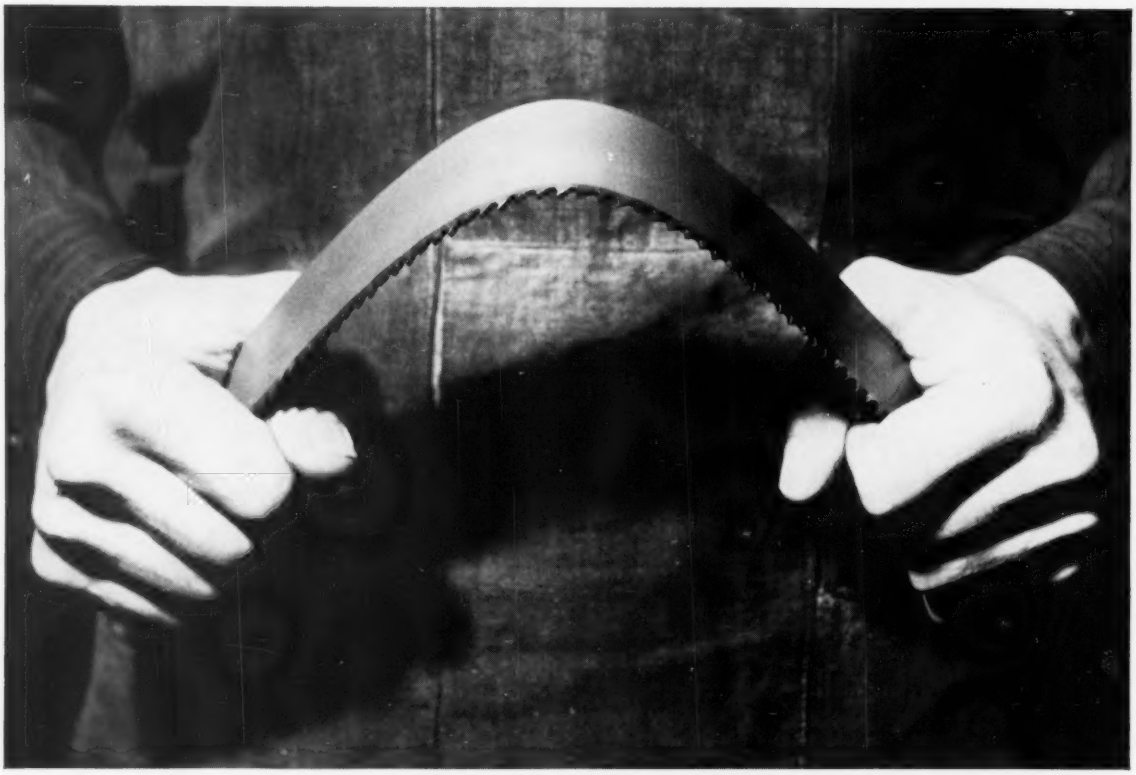
Their distributors and their own service engineers give us wonderful co-operation, too. Yes, I'm sold on GEOMETRIC Die Heads and Collapsing Taps."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

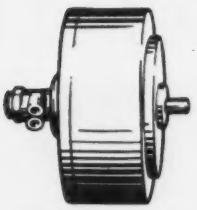
Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

B-1120

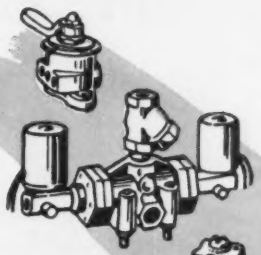
Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

MARVEL Metal Cutting SAWS
Better Machines - Better Blades

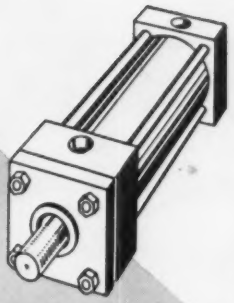
ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.



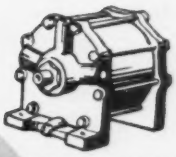
ROTATING AIR CYLINDERS



HYDRAULIC AND AIR VALVES



LOGANSQUARE AIR CYLINDERS



NONROTATING AIR CYLINDERS

specify . . . Logan

YOUR DEPENDABLE *"ONE-SOURCE"* SUPPLIER FOR ALL YOUR AIR AND HYDRAULIC EQUIPMENT..

- ✓ *One-manufacturer responsibility*
- ✓ *One-source manufacturing*
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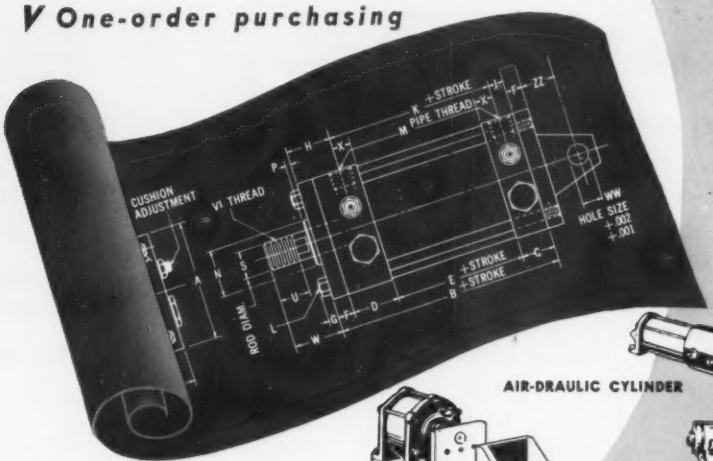
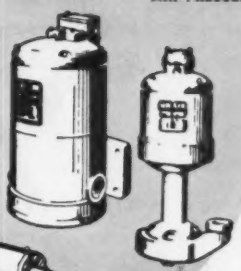
HYDRAULIC AND AIR PRESSES



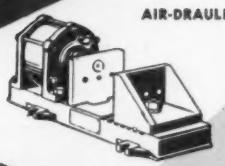


AIR-DRAULIC CYLINDER

SURE-FLOW COOLANT PUMPS

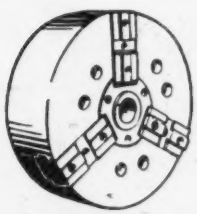
ROTOCAST HYDRAULIC CYLINDERS

MEMBER: Natl. Mach. Tool Builders' Assn., Natl. Fluid Power Assn.

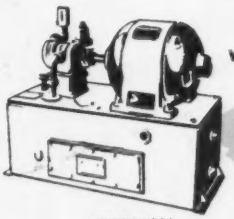


AIR-OPERATED VISES AND FIXTURES

RETURN THIS COUPON FOR FREE ENGINEERING DATA



AIR AND HYDRAULIC OPERATED CHUCKS



HYDRAULIC POWER UNITS

PROPERLY DESIGNED . . .
PROPERLY EQUIPPED BY

Logan — YOUR DEPENDABLE "SINGLE SOURCE" For All AIR or HYDRAULIC Equipment

LOGANSPORT MACHINE CO., INC.
810 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 HYD. VALVES
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- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

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COMPANY _____

ADDRESS _____

_____

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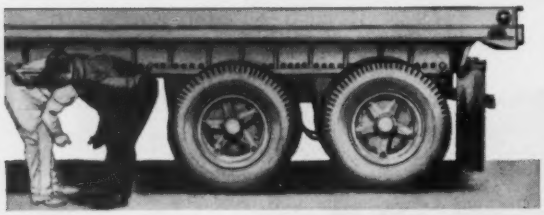
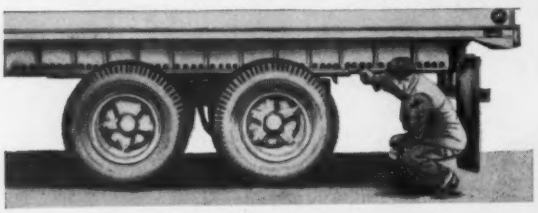
Wrought Everdur* Cuts Cost in Half

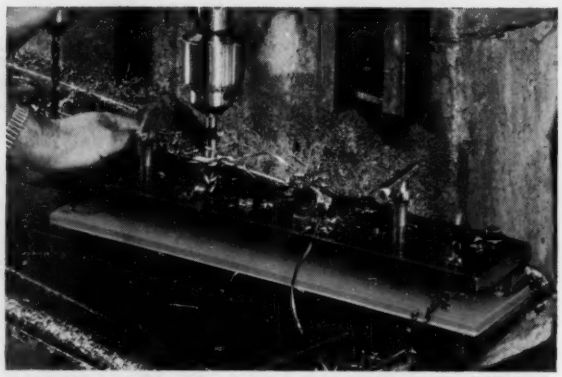


THE TRAILMOBILE SHIFTABLE TANDEM—Truckers often lose time and money in shifting trailer cargo, changing tractors, or cutting payload to meet legal axle-weight requirements. Now, however, they can balance any load in just five minutes by moving the Shiftable Tandem Axle Assembly made by Trailmobile Inc., Cincinnati, Ohio. The axle assembly slides forward or backward, as needed, along a stainless steel rail on four shoes of wrought Everdur. It can move 66 inches and be locked at 3-inch intervals by locking rods through holes in the rail.

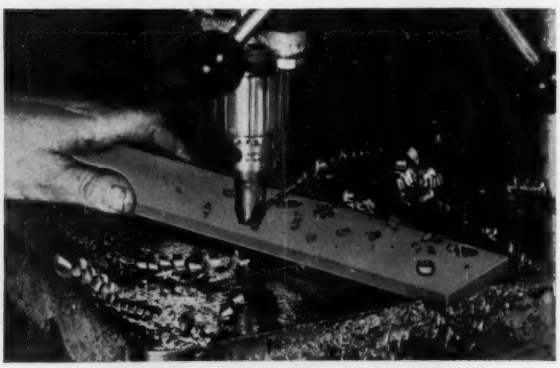


EVERDUR CAN TAKE THE LOADS AND SPLASH—One of the shoes of wrought Everdur installed in the Shiftable Tandem frame. An Alemite fitting in center hole and oil grooves provide lubrication. The Everdur shoes carry normal tandem loads of 32,000 pounds day and night, and slide freely under this pressure. Resistance to corrosion is another reason why Everdur was selected, for unlike the trailer's cargo, the Everdur shoes are exposed to road splash of varied mixtures.

Wherever metal must resist corrosion, be strong and tough, and be available in forms easily fabricated, consider Everdur, Anaconda's family of copper-silicon alloys. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. *Reg. U.S. Pat. Off. 5661



HOW WROUGHT EVERDUR CUT MATERIAL COSTS—Trailmobile first tried high-tin bronze castings for the shoes on which the assembly slides. But rejects for porosity and warpage in the thin cast section were a costly problem—and all surfaces had to be finish-machined. The wrought Everdur bar stock suggested by Anaconda's technical experts has surfaces satisfactory as delivered—ready for drilling holes (shown above).



HOW WROUGHT EVERDUR CUT LABOR COSTS—The castings formerly used were not uniform. Hard spots made surface machining difficult and expensive. The entire operation was unnecessary with wrought Everdur bar stock—reducing labor cost by about 50 per cent. (Above) Countersinking holes for screw fastenings.

WROUGHT EVERDUR IS READILY MACHINABLE—Though tough and dense, wrought Everdur is uniform and poses no special problems in machining. Oil grooves are shown being milled in the shoes.

EVERDUR

ANACONDA® COPPER-SILICON ALLOYS

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now...

ONE COMPLETE REFERENCE FOR YOUR ONE SOURCE OF DIE-SET ACCESSORIES

More than 200 pages featuring the all-new "LEADERSHIP LINE"

Danly's new "Leadership Line" of die sets and diemaker's supplies is a major development in the stamping industry — certain to affect every toolroom and die shop in the country.

That's why Danly's new catalog is a must for every tool engineer's technical library . . . specially edited and arranged to present complete dimensional data. Easy-to-read tables . . . convenient product illustrations and drawings . . . clear indications of all optional features make it a real working tool. Includes all Danly Die-Sets, Die-Set Accessories, Diemakers' Supplies, Bolster Plates and Bolster Accessories making up Danly's all new "Leadership Line". Easy to look at — and easy to get . . .

DANLY

DIE SETS AND DIEMAKERS' SUPPLIES

WRITE FOR YOUR FREE COPY TODAY!

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Dept. C Chicago 50, Illinois

"We have no operating problems

Midwest Metal Stamping reports results of 8 years of press operation using STANOIL

In 1948, Midwest Metal Stamping Company, Kellogg, Iowa, put into service a Bliss Hydro Dynamic Press. STANOIL Industrial Oil was selected as the hydraulic medium. The initial fill was 1,400 gallons. The press operated continuously from 1948 until Christmas, 1954, when it was shut down five days for overhaul.

Stamping being removed from press by operator George Johnson. Press has used STANOIL Industrial Oil as hydraulic medium for eight years. Oil has perfect performance record.

At the time of overhaul, the STANOIL Industrial Oil was drained. And here STANOIL's superior demulsibility was demonstrated. Due to the high rate of condensation, two barrels of water were removed from oil reservoir. An oil analysis in the Standard Oil laboratory proved the oil still suitable for continued service. After filtration, it was returned to the reservoir and the press put back in operation. STANOIL continues to deliver the same perfect performance for Midwest as before.

STANOIL Industrial Oil can perform just as efficiently for you. Find out. There is a Standard Oil industrial lubrication specialist near you in any one of the Midwest and Rocky Mountain states. Call him. Or write Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.

when we use STANOIL Industrial Oil"

Don Foster, Midwest Stamping Purchasing Agent and Jesse Nelson (right), Standard Oil industrial lubrication specialist, display metal blank and finished tub turned out on Bliss press. Technical service on lubrication problems is Jesse Nelson's job. He's been doing such work for seven years. Jesse has an engineering degree from the University of Iowa and is a graduate of the Standard Oil Sales Engineering School. Customers find this experience and training pay off for *them*.

STANDARD

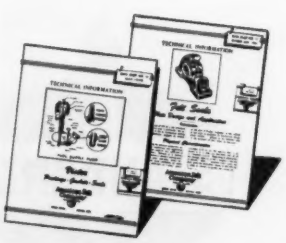
STANDARD OIL COMPANY
(Indiana)

Quick facts about ***STANOIL*** *Industrial Oil*

- **Special refining and an additive, exclusive with STANOIL, make this industrial oil resistant to chemical change.**
- **In all grades of STANOIL that need it, an advanced type corrosion inhibitor is added. Inhibitor "plates out" on metal surfaces, prevents rust.**
- **Selective refining and special additives give STANOIL low pour point. STANOIL flows freely at low temperatures.**
- **High viscosity index of STANOIL is indication of the oil's ability to resist change at any operating temperature.**
- **No foam, no emulsion with STANOIL. STANOIL's special additive and selective refining minimize or eliminate these oil problems.**
- **Low carbon forming tendencies of STANOIL reduce or eliminate this problem.**

The seals shown here are a combination of felt for shaft lubrication, plus spring-loaded leather or rubber for exclusion of water, fumes, dust. Such seals are made by a number of companies, in standard and special diameters. List of firms on request. Felt seals can also be made impervious by metal enclosures, or by the use of felt with one or more laminations of synthetic rubber. Just remember that felt is so versatile that it can either lubricate or seal, or both at the same time. On request we will collaborate on designs and specifications. Write for Data Sheet No. 11, "Felt Seals, Their Design and Application," and for No. 14, "Vistex, Packings, Gaskets, Seals."

American Felt Company
TRADE MARK ®



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SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Greenville, S. C., Dallas, San Francisco, Los Angeles, Portland, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.—ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

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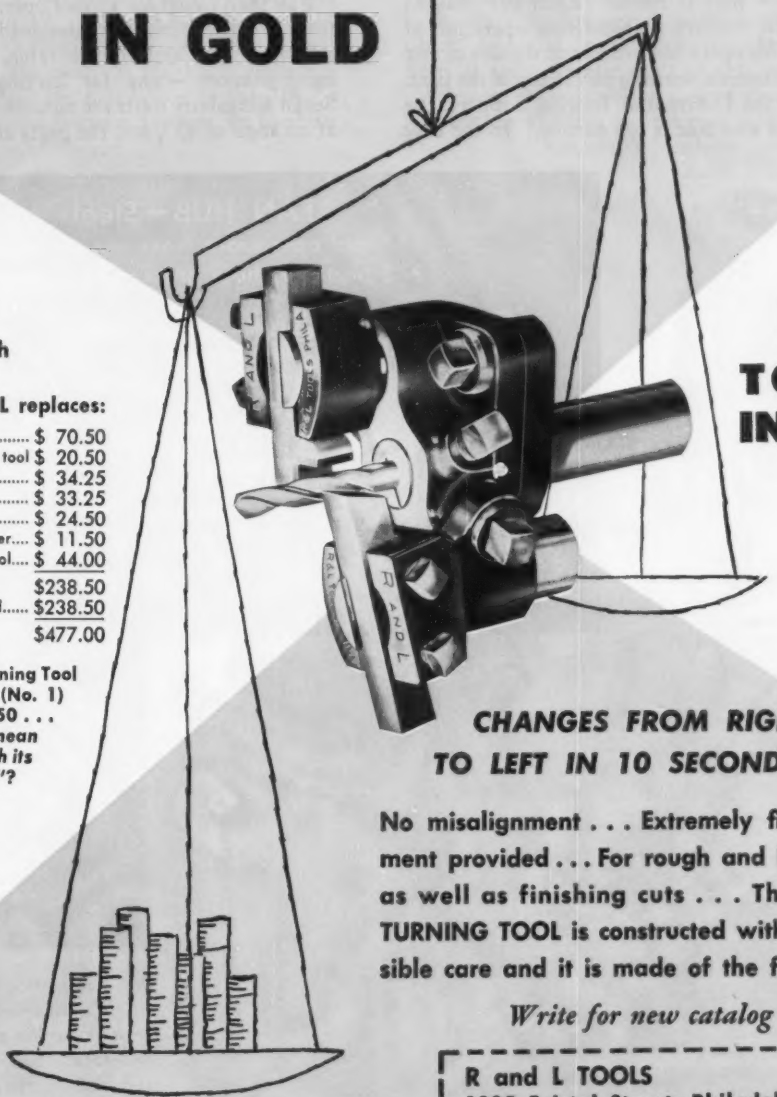
WORTH ITS WEIGHT IN GOLD

R and L TURNING TOOL



Here are the tools which the R and L TURNING TOOL replaces:

Roller Box Tool	$ 70.50
Centering & facing tool	$ 20.50
Knee Tool	$ 34.25
Pointing Tool	$ 33.25
Back Rest	$ 24.50
Floating Drill Holder	$ 11.50
Balance Turning Tool	$ 44.00
	$238.50
Same for left hand	$238.50
	$477.00

One R and L Turning Tool of similar size (No. 1) costs only $87.50 . . . *See what we mean by being "Worth its weight in gold"?*

14 TOOLS IN ONE

CHANGES FROM RIGHT TO LEFT IN 10 SECONDS

No misalignment . . . Extremely fine adjustment provided . . . For rough and heavy cuts as well as finishing cuts . . . The R and L TURNING TOOL is constructed with best possible care and it is made of the finest steel!

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☐ Please arrange for no-obligation demonstration of R and L TOOLS

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M-5.

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

"Operations Kingsbury" The result is always

The simple operations performed by these two Kingsburys might lead one to ask: "Why use automatic drilling and tapping machines for this work?"

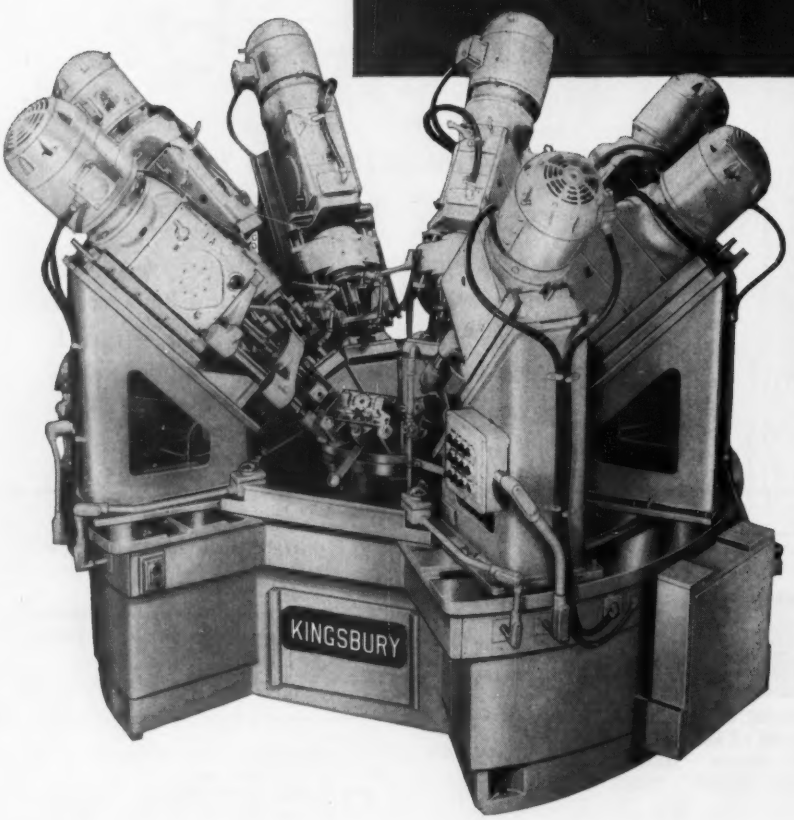
Let's take another look.

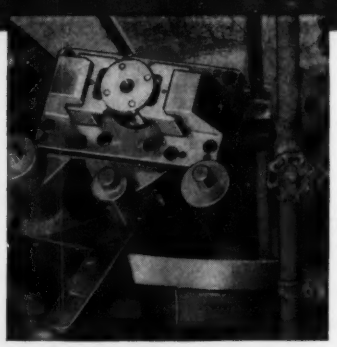
Notice that the two parts have several features in common. Each part is round. Each part has an axis hole which requires a chamfering operation at the "top." This operation prevented the use of any hold-down mechanism working on the top of the part. In the case of the Differential Bearing Support, the rim around the axis hole is too narrow. In the case of the Fan Hub, the top surface is wide enough, but specifications called for facing this surface.

So, in each case we used opposing jaws. These jaws grip the outside diameter and hold the part in a vise-like grip.

Fan Hub called for 17 tool operations — normally from two directions. We designed the machine with a 96-inch base and 26-inch table, indexing through eight stations — one for loading and unloading. Seven Kingsbury units are mounted on the base, each at an angle of 45°, and the parts are presented in the

FAN HUB — Steel
17 tool operations from one direction
272 parts per hour gross — 3 1/10 ¢ per part
FOUR HOLES 5/16 - 24 thds
STA. 2-A: Tap drill
STA. 3-A: C'sink
STA. 4-A: Tap
AXIS HOLE .6329/.6402
STA. 1-A: Chamfer hole and face end
STA. 5-A: End ream
STA. 6-A: Finish ream
STA. 7-A: Burr





Fan Hub part is held with axis hole at 45°, flat side up. Two serrated jaws clamp the part just below the flat face. Bushings guide tools as required. Fixture is manually loaded and clamped; is automatically unclamped for manual unloading.

the same: interchangeable parts at low cost

fixtures at this same angle. Fixtures are loaded and clamped manually — unclamped automatically.

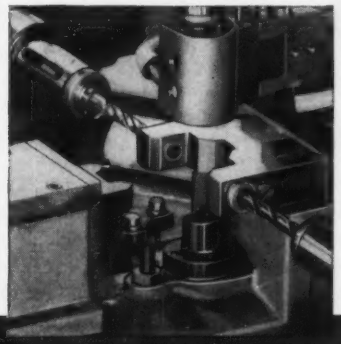
All work is performed from one direction. At *Sta.* 1-A a combination tool faces the top surface and chamfers the axis hole. At *Stas.* 2-A, 3-A and 4-A the four holes are tap-drilled, countersunk, and tapped for 5/16-24 thread. Units at *Stas.* 5-A and 6-A end-ream and finish-ream the axis hole .6392/.6402 dia. To remove the burr on the back we use a recessing tool through the axis hole — at *Sta.* 7-A.

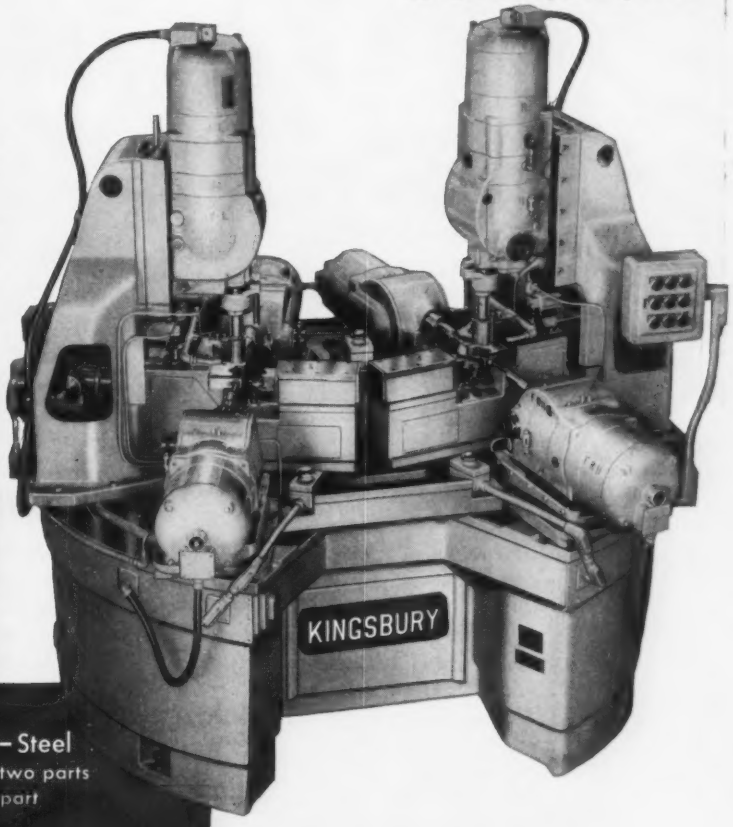
For the Differential Bearing Support we used an 80-inch base and two stationary work-holding fixtures, one at the left and the other at the right — actually two machines on one base. The part is placed in each fixture with the axis vertical, tapered end at top. The opposing jaws of the fixtures clamp and unclamp automatically. Horizontal front and back units are equipped with combination tools which drill and countersink the .3437 dia. holes. Vertical units chamfer the 1.48 dia. hole.

Why use a Kingsbury in each of these cases? For high output with low cost per part — *as usual.*

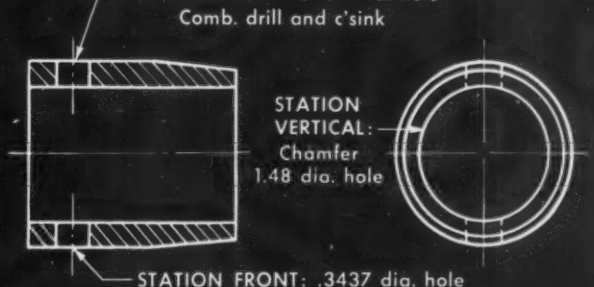
Kingsbury Machine Tool Corporation
117 Laurel St., Keene, N. H.

Differential Bearing Support part is held with axis hole vertical and tapered end at top. Two jaws (one fixed, one movable) clamp the part on the outside diameter. Bushings in the fixture guide the drills. Fixture clamps and unclamps automatically; loading is manual.





DIFFERENTIAL BEARING SUPPORT – Steel
Three operations from three directions on two parts
492 parts per hour gross — 1 2/10 ¢ per part



KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

Why the Die Maker Prefers PRODUCTO Die Sets

Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

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Wherever die sets are used

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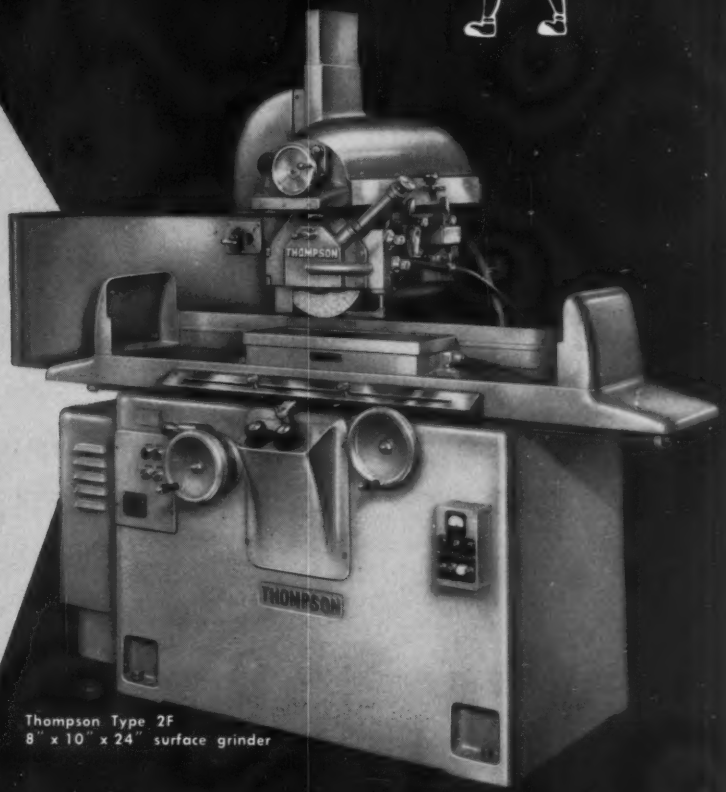
PRECISION PETE SAYS:

Only Thompson Type 2F Grinder has all three available . . .

1 COOLANT THRU THE WHEEL . . .

2 . . . COOLANT EXTERNALLY ON THE WORK . . .

3 . . . AND "IN POSITION" WHEEL TRUING



Thompson Type 2F
8" x 10" x 24" surface grinder

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SURFACE GRINDERS

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THE THOMPSON GRINDER COMPANY
SPRINGFIELD, OHIO

Thompson SURFACE Grinders

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exclusive double lube protection for new top drive full eccentric presses

New from Hamilton . . . two major mechanical press developments in one . . . a complete new line of welded steel, top drive, full eccentric presses from 300 to 4000 tons . . . an exclusive new double lube system protects each press for extra-long, trouble-free service and for smoother, precision performance.

Hamilton double lube is a combination of a carefully engineered pressure oil lubrication system PLUS a complete set of troughs and gravity flow channels to provide gravity lubrication. All bearings are positively lubricated even if pressure and flow switches should fail. Double lube is double insurance against lubrication failure—a major cause of costly downtime.

In addition, this line features Hamilton's new air clutch, which combines all the advantages of two types . . . low inertia and mechanical interlocking.

Hamilton—pioneer of the giant automotive stamping presses—meets today's demand for higher quality, faster production, less downtime. Put this know-how to work for you! Send for the full story. Write Dept 4419, Hamilton Division, BLH Corporation, Hamilton, Ohio.

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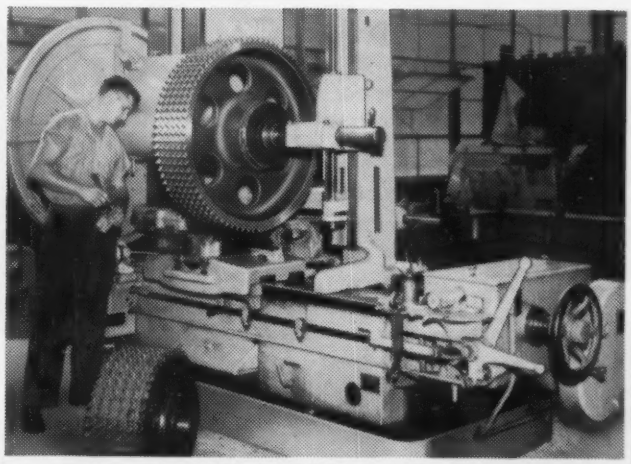
in case you missed the News!

Newark Gear Cutters and Hobbers

are now manufactured by POTTER & JOHNSTON COMPANY at the P&J plant, Pawtucket, Rhode Island

TO AVOID DELAYS AND TO INSURE PROMPT ATTENTION AND HANDLING, PLEASE ADDRESS ALL INQUIRIES AND ORDERS DIRECT TO POTTER & JOHNSTON AT PAWTUCKET.

As previously announced, assets of the Newark Gear Company have been acquired by Potter and Johnston Company, subsidiary of Pratt & Whitney Company, Incorporated. In addition to the complete line of P&J Automatic Chucking Turret Lathes, these long-famous automatic gear machines are now being manufactured in our Pawtucket, Rhode Island plant. Product literature, including complete specifications and engineering data, is available. Write on your Company letterhead outlining your requirements.



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STANDARD DETROIT PRESS

broaches oil groove in

700 BEARING RACES/Hr.

This application shows the versatility of Detroit Broach standard presses. Tooled for automation, parts are magazine fed from the preceding operation, broached and then dropped into a tote basket ***without an operator.*** Parts can also be chute-fed to next operation.

An important advantage of this type of automation lies in the fact that if the operation should be obsoleted, this standard press can be applied, without change, to another operation.

Detroit Broach standard 1-ton, 12″ stroke, Gooseneck press.

Detroit Broach standard 10-ton, 30″ stroke, Side Plate press.

STANDARD DETROIT PRESSES

for BROACHING ★ ASSEMBLING ★ STRAIGHTENING

★ Complete range of sizes and strokes in both Gooseneck and Side Plate presses.

★ Sensitive, positive control of ram speed, force, travel and direction of movement.

★ Rigid construction with compact, fully-enclosed operating mechanism.

★ Simple manual, semi-automatic or fully automatic control.

★ Powered by dependable Oilgear fluid power system.

Detroit Broach COMPANY

ROCHESTER, MICHIGAN

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As specified to 60"

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Catalog standards, including standard alternates.
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Normally any quantity you need for rush jobs.
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ANTISEP the all-purpose water-soluble cutting base

Cool Profits...when ANTISEP works for you!

"Cool" is the keyword in figuring machine tool profits. And Antisep All-Purpose Base gives you the cooling action of a mountain stream . . . with faster, cleaner cutting, too! Its tough film and extra lubricity insure fast, free cutting on tough metals. Its speedy water cooling takes heat away from tools and works faster than any straight cutting oil could. It is anti-welding, helps prevent chip build-up on tools.

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ANTISEP ALL-PURPOSE CUTTING BASE

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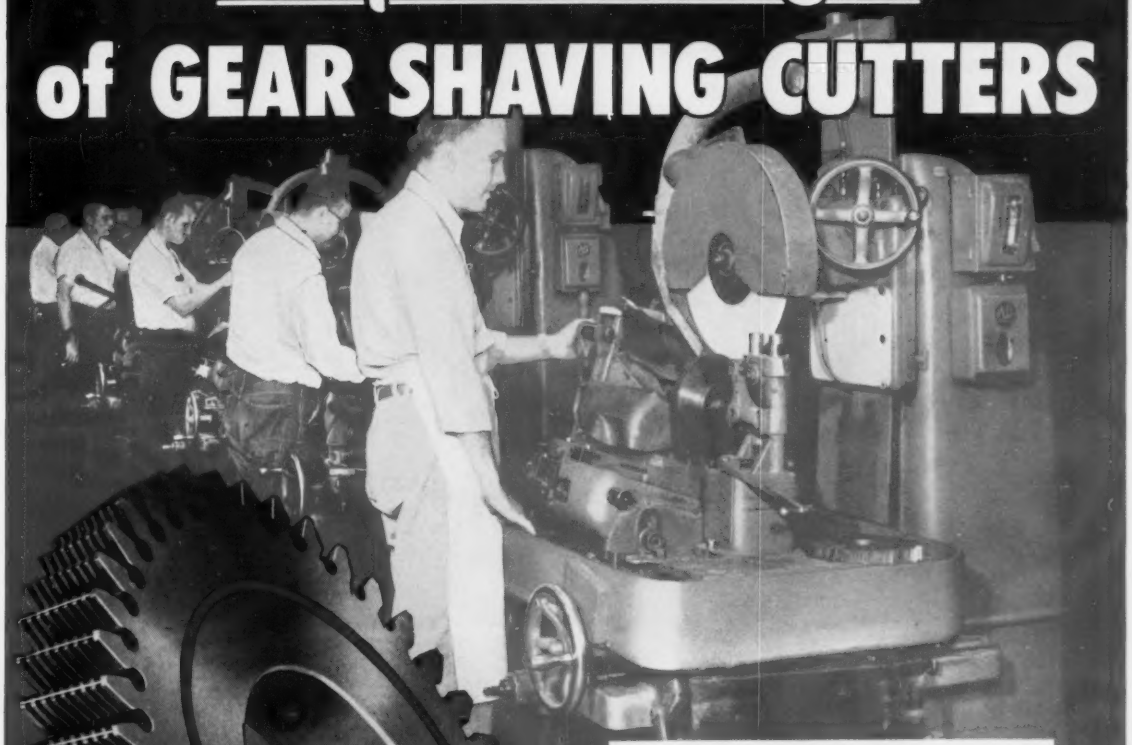
Ready to give you on-the-job service . . .

A Tip to the Buyer of GEAR SHAVING CUTTERS



Engineers of the Red Ring Cutter Division are concerned with gear shaving cutters exclusively. The same applies to this Division's manufacturing personnel. These men have no other job responsibility. And, in 25 years they have accumulated more experience in this highly specialized field than any other group anywhere. Machines and equipment for the production of cutters are used for no other purpose.

This experience is part of every Red Ring Cutter you buy. When you encounter a tough problem you can call for help. When you need a cutter to produce a gear with certain special characteristics Red Ring specialists will develop it.

Don't underestimate the value of this extra protection even though it isn't apparent in the price you pay for Red Ring Gear Shaving Cutters.

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ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

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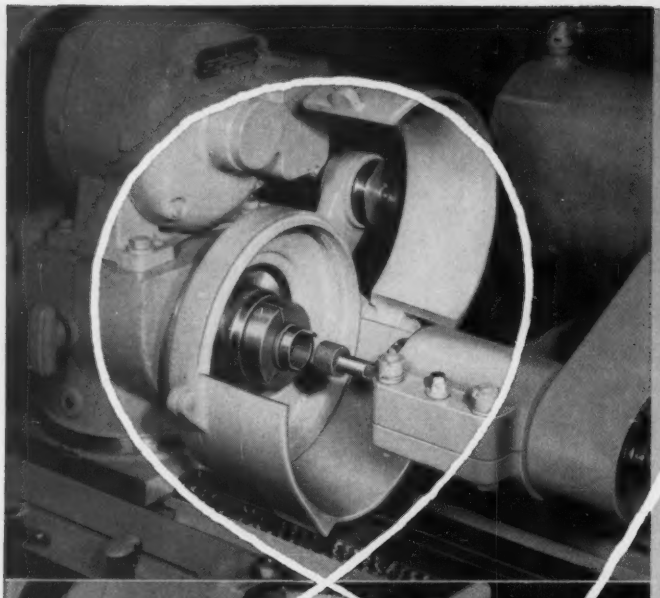
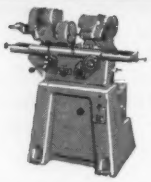
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



RIVETT

MODEL 84

INTERNAL-EXTERNAL GRINDER

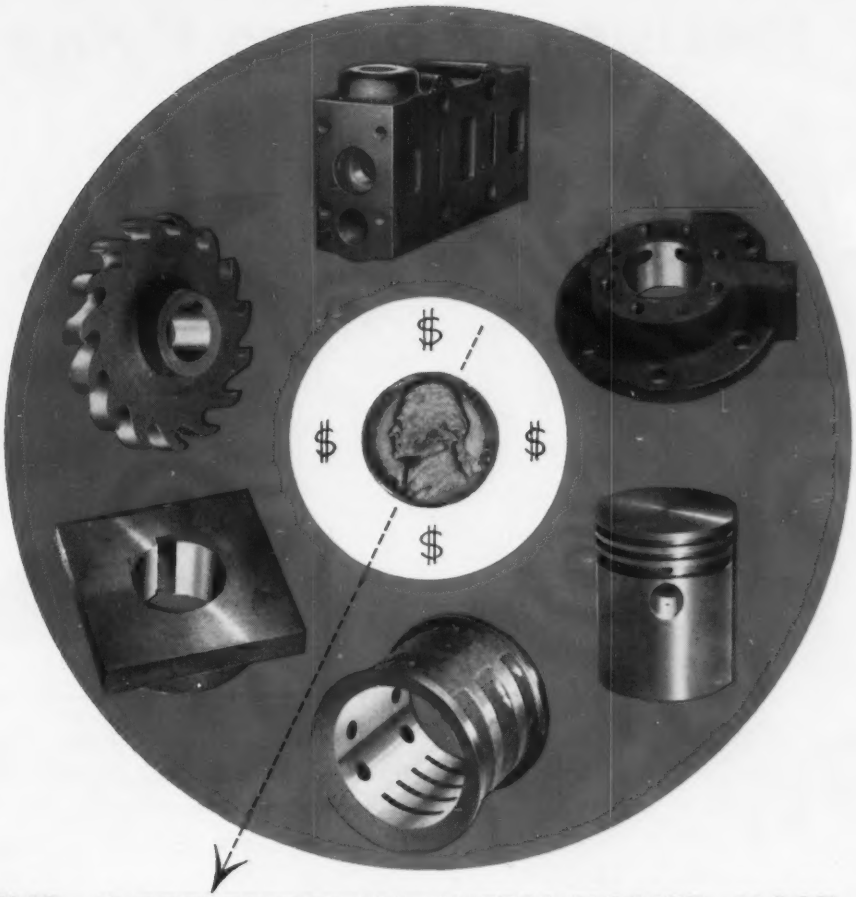


This small hole grinder mounts interchangeable wheelheads for internal and external spindles. Hole capacity is 3" dia. with a maximum depth of 4"; external is to 3" dia. by a 4" length. Collets and step chucks mount directly in lathe-type spindle.

This flexibility combined with the inherent accuracy is why the Rivett 84 has gained great popularity in toolrooms since its introduction to the trade twelve months ago.

Quick and easy to set up, the 84 will handle your diversified jobs faster, too. All the details to prove this are shown in Catalog No. 84-A. **Write for a copy today!**

RIVETT LATHE & GRINDER, INC., DEPT. MR-5, BRIGHTON 35, BOSTON, MASS.



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1. It eliminates chucking and set up (you often complete the job in less time than required to set up other machines).
2. Interchangeability of honed parts makes assembly of mating units faster, easier.
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6. Assures longer product life with less maintenance.

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COMPANY_____
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CITY_____ ZONE____ STATE_____

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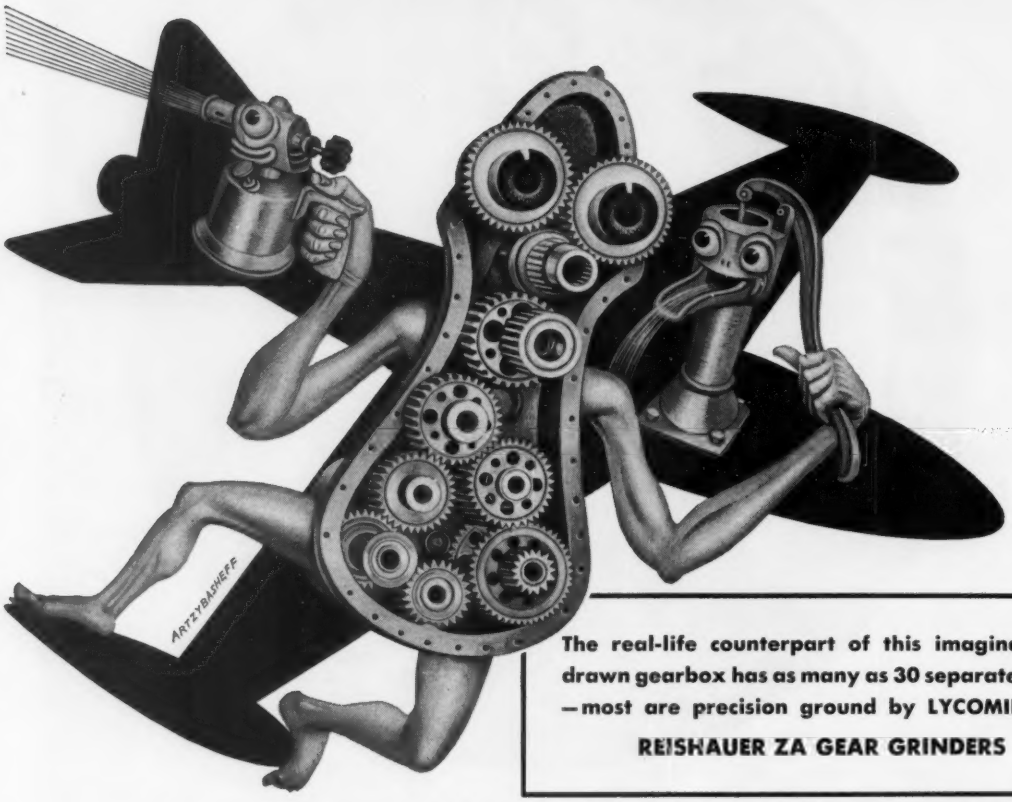
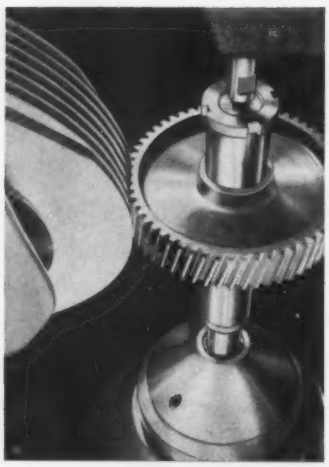
Precision gears go flying



The real-life counterpart of this imaginatively drawn gearbox has as many as 30 separate gears —most are precision ground by LYCOMING on

REISHAUER ZA GEAR GRINDERS



Single-thread grinding worm and spindle of the Reishauer ZA.

Auxiliary "nerves" of the mighty J-40 and J-47 jet engines, these precision gears transmit power to run fuel and oil pumps, generators, and other vital accessories. Lycoming, maker of this intricate gearbox, depends on Reishauer ZA gear grinders for precise, rapid production of gears.

Lycoming likes the way Reishauer consistently produces gears to extremely close tolerances at high production speeds. Furthermore, operators on the production line benefit from the simplicity and cleanliness of the machines' operation.

Lycoming is not alone in its respect for Reishauer grinders—these machines are widely used to grind spur and helical gears in the automotive and aircraft industries. Other users include machine tool builders, gear-jobbers, and instrument manufacturers.

In short, Reishauer ZA grinders are excellent machines. If you want proof, we'll be happy to supply it. Get in touch with us soon, won't you?

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

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IN CANADA contact COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario

THEY WOULDN'T BELIEVE IT

—until they SAW it!

Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough alloy steel forgings. So they came to see for themselves and they saw:

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2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

They were amazed and convinced.

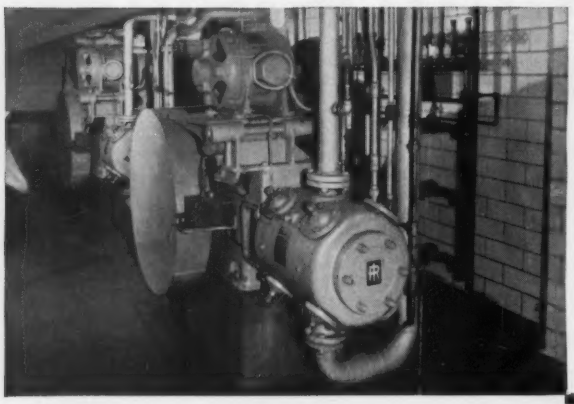
This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

AIR POWER when you need it ...with an ES compressor

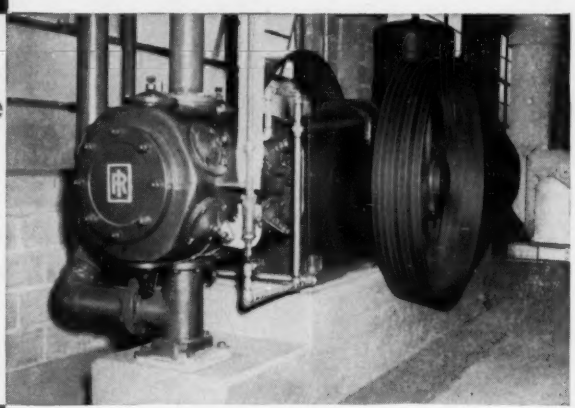


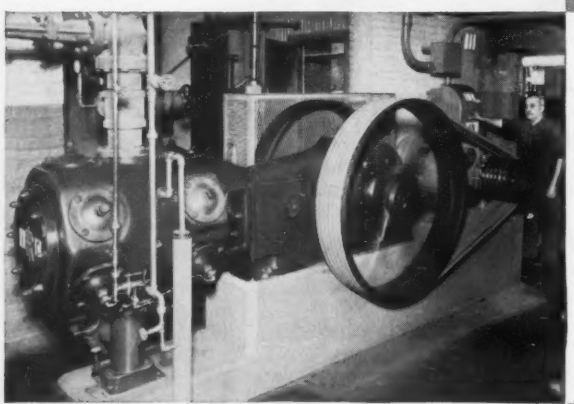
24 Hours a Day

These two Ingersoll-Rand ES compressors are on duty continuously, 24 hours-a-day—supplying instrument air for a large central station power plant. An interrupted air supply at constant pressure is essential to the proper functioning of automatic control instruments that have to stay on the job around the clock, month after month, year after year. The overhead motor mounting is but one of the many drive arrangements available.

20 Years of Service

Installed over 20 years ago, this Ingersoll-Rand ES compressor is still in excellent condition — still doing its job dependably, compressing air to 100 psi for general shop service in a large southern manufacturing plant. ES compressors of this age are a common sight in industrial plants all over the country — attesting to the tremendous stamina and long-life built into these heavy-duty machines.





No Forced Shutdowns

Here is one of six 75-hp ES compressors supplying low pressure air in a New England glass manufacturing plant. Since any interruption would result in costly damage to equipment and materials, this company uses dependable ES compressors to furnish a constant supply of process air. Here, as in many other applications, these trouble-free compressors have proven themselves, even under the most adverse conditions.

Ingersoll-Rand ES compressors are available in sizes from 5 to 125 horsepower and for pressures to 2500 psi and vacuums. Horizontal or overhead v-belt drive, direct-connected synchronous motor or steam drives are available. Ask your I-R representative for further details on the unit best adapted to your specific compression problem.

Only I-R compressors have CHANNEL VALVES

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and leaf springs, with trapped-air spaces which cushion action.

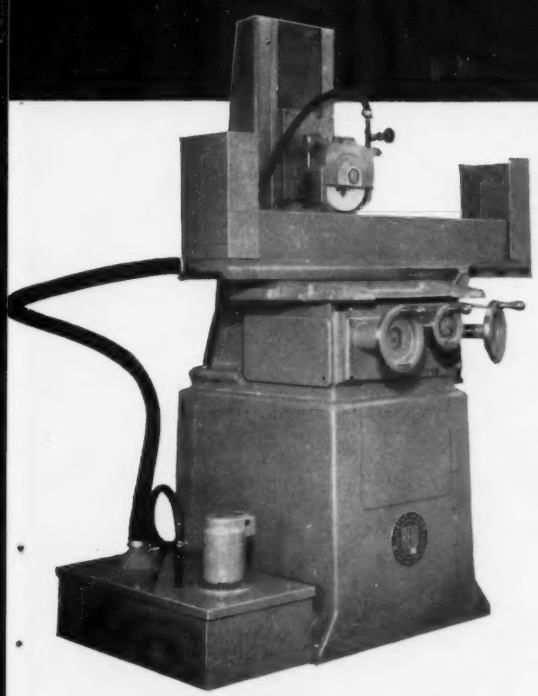
Ingersoll-Rand

1-393

11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS AND DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR AND ELECTRIC TOOLS

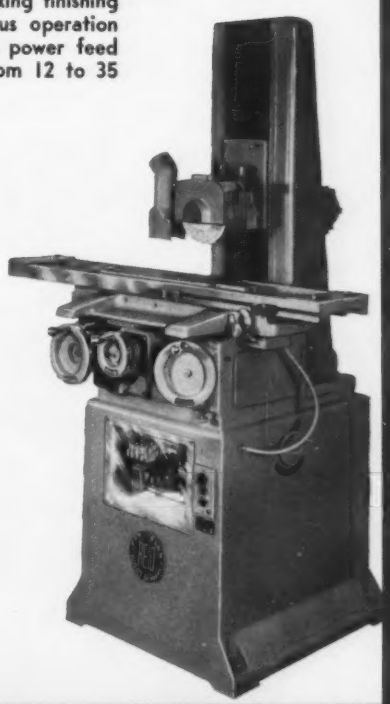
REID sets the standard for precision surface grinding...



MODEL 618H convenient finger-tip level controls for all operations make this grinder the favorite of the toolroom for the finest tool and die grinding. Accessories, including Cool-Grind or wet grinding attachments, magnetic chucks and form dressers give extreme versatility for all operations.

MODEL 618VL designed for precision grinding to the finest tolerances with superior surface finish . . . rugged construction and painstaking finishing give true dependability for continuous operation with minimum maintenance. Features power feed table with traverse speed variable from 12 to 35 feet per minute.

Photo courtesy Robertson Mfg.,



SPECIFICATIONS

CAPACITY: 6" wide, 18" long, 17¼" high from spindle center to table.
WORKTABLE: 51" x 8" overall.
FEED RANGE: Elevating hand wheel (r.) graduated to .0005" (optional, vernier to .0001"); cross feed to .001"; power cross feed adjustable .006" to .100" at either or both ends of table reverse.
GRINDING HEAD: with 3" opening for standard 1 h.p. cartridge type motorized spindle. Wheel size: 7" x ½" x 1¼".
FLOOR SPACE: 71" x 43½"
WEIGHT: 2100 lbs. net

Write for Bulletin 618-2

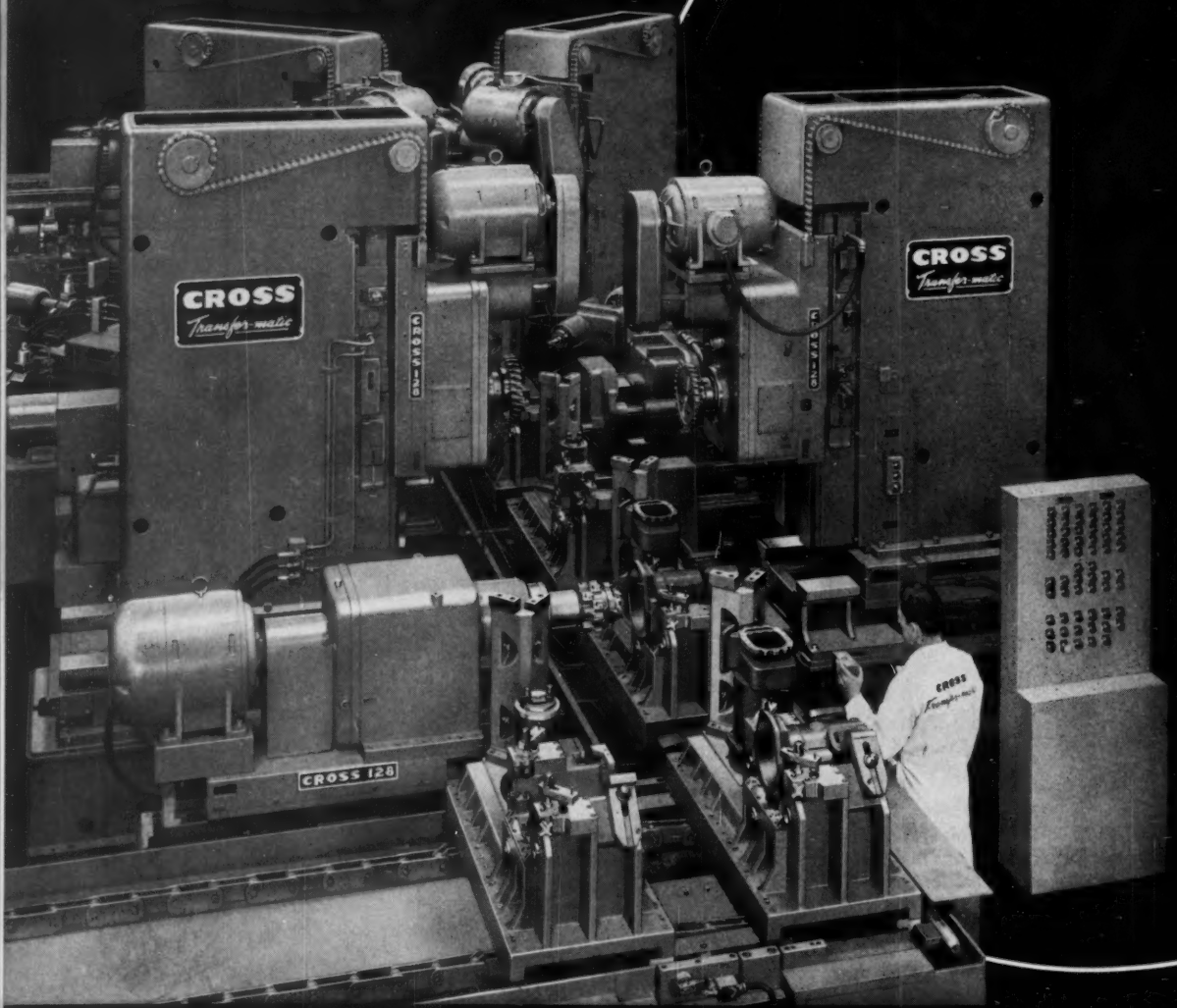
Reid Brothers Company, Inc.

BEVERLY MASSACHUSETTS

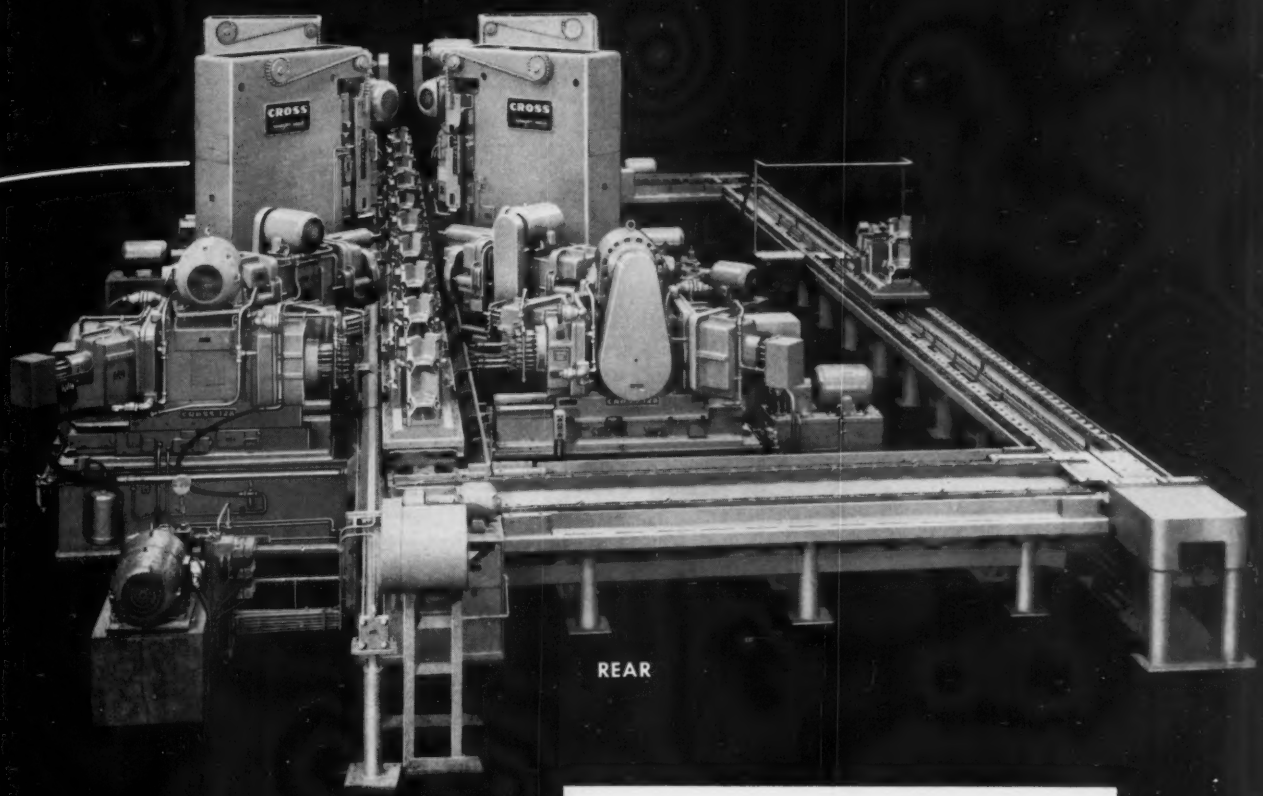
Completely Machines Air Conditioning Housings

(from Rough Castings to Assembly)

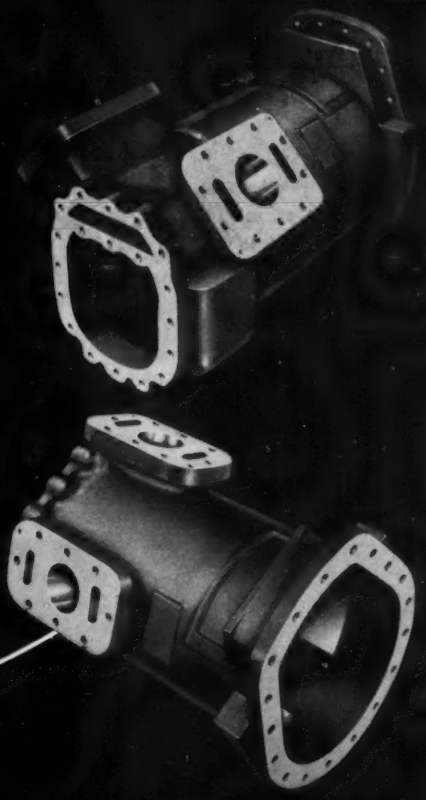
Another Transfer-matic by Cross



OPERATOR'S STATION



REAR



- ★ 18 pieces per hour at 100% efficiency.
- ★ 159 operations: 6 milling, 6 boring, 1 facing, 81 drilling and 65 tapping.
- ★ Two-position, progressive type, palletized work holding fixtures for carrying the parts from station to station.
- ★ Modular unit construction provides flexibility for part design changes.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping; automatic lubrication; automatic chip conveyor.

Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

Extra Rugged...

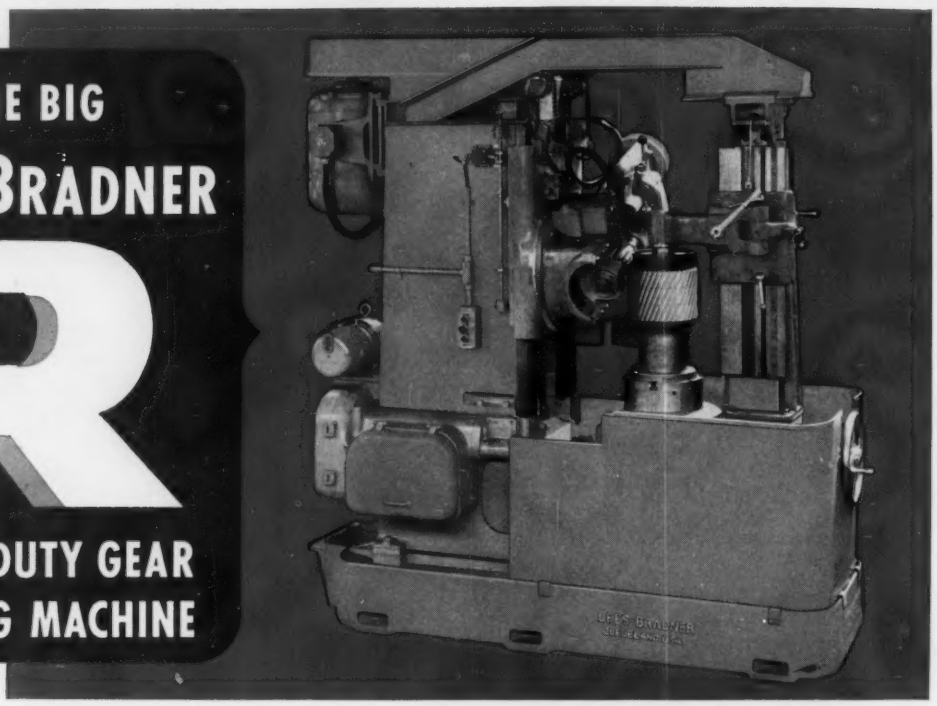
For The ROUGH Hobbing Jobs!

THE BIG

LEES-BRADNER

R

HEAVY-DUTY GEAR HOBBING MACHINE



Built rugged and reliable to handle those rough, tough gear hobbing jobs . . . that's the new Lees-Bradner Model "R".

It's designed to hob spur or helical gears up to 1¼ DP with a left or right hand maximum helix of 45°.

The Model "R" features fast loading and unloading, ready access to index and feed change plus easy operation and maintenance.

Write for your free brochure giving the detailed capacities and specifications of this new heavy-weight hobbing machine.

SPECIFICATIONS

Maximum outside diameter	
with tailstock column	16"
without tailstock column	18"
Minimum C/D hob to work	1½"
Maximum C/D hob to work	12"
Travel	18"
Maximum diameter of hob (3-1, 6-1, or 12-1 backgearing)	10" x 10"
DP range	1¼ DP to 16 DP
Maximum manual (or electric) shift of hob	6"
Diameter of hole through work spindle	2"
Machine weight	13,000 lbs.

the **LEES-BRADNER** *Company*

CLEVELAND 11, OHIO • U.S.A.

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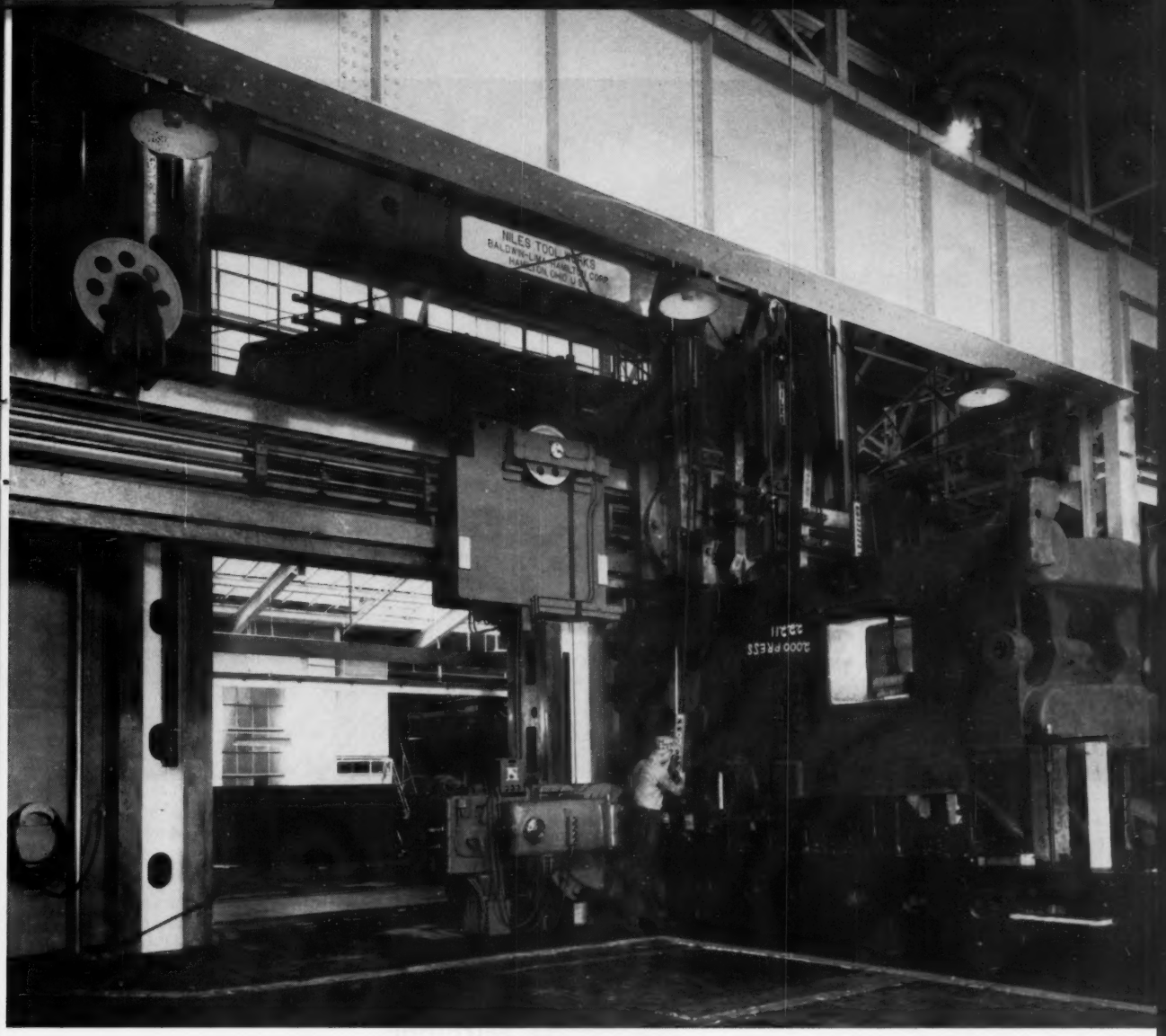

At National Machinery

new Niles 23-ft. planer handles any casting that can be shipped by flatcar

With this new Niles 23-ft. planer, National Machinery Company—outstanding manufacturers of hot and cold forging machinery—has the answer to reducing over-all setup and machining time at their Tiffin, Ohio plant. They've found this huge machine combines the rigidity and accuracy of a double housing planer with the versatility of a convertible planer. It's being used chiefly to machine planed surfaces of beds for forging machines ranging up to 130 tons. With it they can plane—in one setup—any size casting that can be shipped by flatcar.

You, too, can profit from the unmatched engineering know-how, experience and facilities that back every Niles machine tool. Notable Niles achievements include the design and manufacture of some of the largest machine tools ever made . . . lathes with 10-ft. swings, boring mills with 43-ft. tables, planers with 23-ft. clearance between housings. Whether your jobs be big or small, you'll discover Niles tools operate at highest production speeds to meet heavy production demands . . . to give you top quality output at the lowest possible operating cost. For complete details on the Niles Tool family, write now to Dept. 9819, Hamilton Division, BLH Corporation, Hamilton, Ohio.

BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON
DIVISIONS: Austin-Western • Eddystone • Electronics & Instrumentation • Lima • Hamilton • Loewy-Hydropress • Pelton • Madsen • Standard Steel Works

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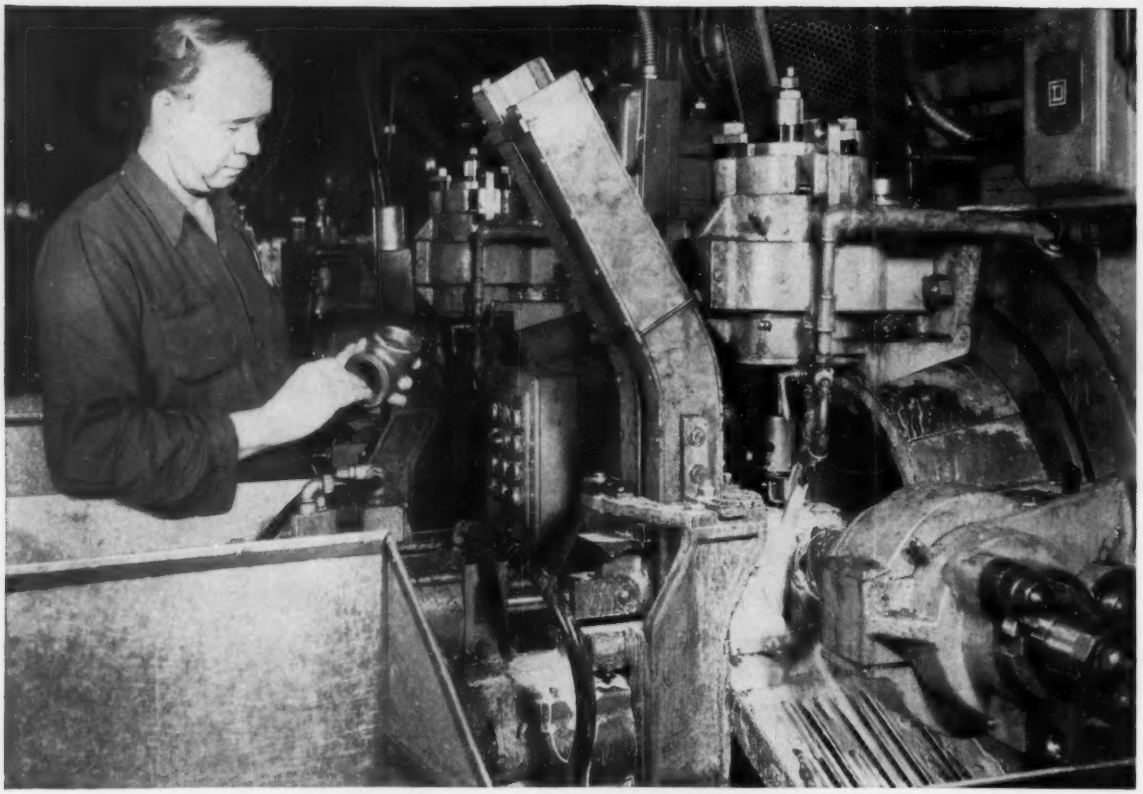

Detroit Brass & Malleable Co. is one of the largest manufacturers of plumbing and drainage fittings in the Midwest. Over 3 million fittings are turned out each month on these automatic tappers. A 10:1 emulsion of *Texaco Soluble Oil C* is used exclusively as the cutting fluid.

"We proved it pays to use Texaco"— says Mr. Robert Welch, General Foreman, Detroit Brass & Malleable Co., Wyandotte, Michigan

THIS PLANT had been using *Texaco Soluble Oil C* in its automatic tapping machines for 15 years. Results were excellent. But how about economy?

To answer this important question, Texaco was tested against 14 other brands. On the basis of test runs, machines were changed over to a less expensive oil that *seemed* equal in quality to Texaco.

"After 30 days with the new oil," reports Mr. Welch, "tool life was shorter than it had been with Texaco, and rusting was a serious problem. We went right back to Texaco, and are again getting longer tool life, better finish without a trace of rust, and more profitable production."

This typical experience points out one important fact: whatever the stock, however you machine it—there is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you get the job done better, faster and at lower cost.

A Texaco Lubrication Engineer can help you bring these benefits to *your* plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE on television . . . Saturday nights, NBC.

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- **Industry—$35,000,000,000 customer**
- **Defense—another $35,000,000,000**
- **Shipments down, hopes up**

Keeping up with Washington

By Loring F. Overman

WHAT is machinery's share of the estimated $35,000,000,000 plant and equipment expansion program in 1956? This total, forecast by the Commerce Department and the Securities and Exchange Commission, is 22 per cent ahead of 1955, or $6,100,000,000! Machinery people can approximate their "take" this year from the following breakdown, expressed in millions of dollars:

	1955	1956
Manufacturing	$11,439	$15,036
Mining	957	1,141
Railroads	923	1,307
Transportation other than rail	1,602	1,784
Public utilities	4,309	4,989
Communications	9,471	10,636
Total	$28,701	$34,893

The $35,000,000,000 forecast of expenditures for plant and equipment is only half of the 1956 industrial story. The other half concerns raw materials to feed the new plants; expanded outlets to distribute the finished products; and, it is hoped, the beginning of an entirely new cycle of demand, expansion, and further production.

Defense Needs

The defense program, another $35,000,000,000 customer for machinery and the things machinery makes, shows no signs of retrenchment. Congress has indicated that the Air Force might be able to use another $1,000,000,000 or so, to bring its strength up to Russia's. In this respect, Defense Secretary Wilson contended that no commander ever felt that he had enough supplies or men. However, the Secretary is supporting present plans to keep expenditures near the $35,000,000,000 mark.

On the premise that our own requirements must be governed by far more than Soviet statistics, Mr. Wilson stated how the Defense Department has deliberately shifted the entire defense effort from arbitrary, unrealistic, short-range goals to long-range objectives adjustable to expected needs. For the moment, it seems that the machinery industry may expect the status quo to prevail in Mr. Wilson's department.

The Office of Defense Mobilization has asked Congress for a two-year extension of the Defense Production Act. Needed, ODM officials say, is authority to: (1) Continue priorities and allocations programs under the Defense Materials System. The system channels scarce materials during temporary shortages, and provides a framework for a full-scale defense plan, if necessary. (2) Expand the nation's production capacity as required. This phase includes, for example, the machine tool pool order program. (3) Provide funds for expansion programs, or for quick-restoration programs in case of attack. ODM sees no need for stand-by authority to freeze prices or wages. Congress, it is felt, would provide such authority overnight, if necessary.

Shipments and Orders

With industry's outlook for 1956 raised by cheering forecasts, the outlook for metal-working machinery shipments this year appears less depressing. The Bureau of Census reports 1955 shipments at $840,828,000. This figure includes $633,794,000 of cutting type machines and $207,034,000 of forming type machines. In comparison, 1954 shipments amounted to $1,072,799,000, consisting of $821,450,000 of cutting type machines and $251,349,000 of forming type machines. On the other hand, new orders during 1955 increased 88 per cent from the 1954 level. In 1955, orders consisted of $918,005,000 for the cutting type and $378,107,000 for the forming type—a total of $1,296,112,000. Orders for the two types in 1954 were, respectively, $523,188,000, and $164,846,000—a total of $688,034,000.

Washington Briefs

Steel Capacity—The Iron and Steel Division of the Business and Defense Services Administration is conducting a new study of required basic steel capacity. Present annual capacity is 126,000,000 ingot tons, with a 15,000,000-ton expansion already announced. It is estimated that industry will require 117,000,000 tons, with fixed defense needs taking a minimum of 18,000,000 tons.

Bigger Cabinet?—Department of Mineral Resources would be a new cabinet-level department if Congress accepts a bill introduced by Senator James Murray (D., Mont.). Senator Murray believes mineral resources should not be dealt with by an agency concerned principally with electric power, irrigation, public lands, and Indians.

Copper—No more copper will be delivered to the federal stockpile this year, according to an ODM order. Delivery of approximately 36,000 tons is deferred by the order.

Nickel—Nickel also will be diverted from the stockpile and flow to industry. Involved are over 6000 tons. Despite current easing, long-range demands in missile programs are cause for concern.

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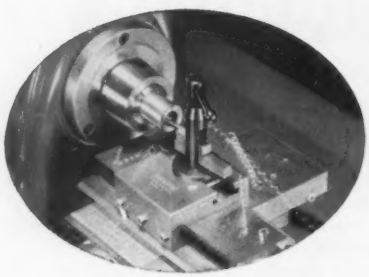
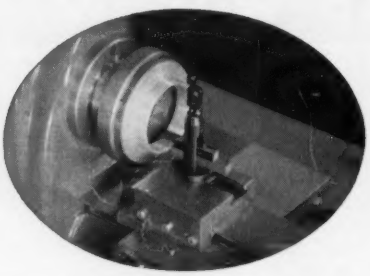
HIGH SPEED PRECISION LATHE

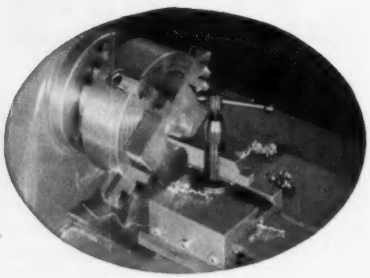
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of one-inch or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".

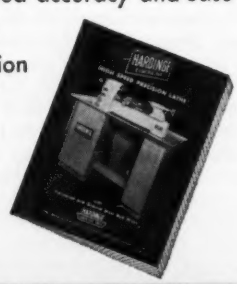


Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1" Collet Capacity
9" Swing
17" Center Distance
8 Speeds to 4000 rpm.

The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV59 High Speed Precision Lathe.

Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 4000 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results.



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MACHINERY
MAY 1956

No Time to Read

MOST of the knowledge that anyone possesses has been imparted to him by others, either through the medium of the printed page or by word of mouth and actual demonstration. One's own discoveries in a particular line of endeavor are generally founded on knowledge accumulated from the recorded experiences of past and present experts in the same field.

Life is too short for mathematicians to discover for themselves principles that have been accepted since the days of Pythagoras or Euclid—or for inventors to question the effectiveness of the screw, which has been well known since Archimedes—or for philosophers to spend hours on end evolving ideas promulgated in the days of Socrates.

No one can hope to get ahead in his chosen line of work unless he keeps abreast of the developments in his field. There is only one way to do that effectively, and that is by reading the technical or trade magazines and text-books that cover the particular phase of industry or business in which the individual is engaged. Dependence upon hearsay or casual references is wholly inadequate.

Some people say that they have no time to read the magazines and text-books of their trade or profession. Yet, the time available now for recreation is vastly greater than that of our ancestors who worked ten to twelve hours a day and six days a week. True, there are many more forms of diversion today, such as golf, moving pictures, and television to distract people. But if some of the time ordinarily spent in recreation were devoted to study, in order to increase the capacity to earn a livelihood, it would surely pay large dividends.

While a college education has been available to many more people in recent years than in earlier days, those who have not had the opportunity for advanced formal education need not lack instruction in any line. History books are full of Lincolns, Edisons, and Fords who made good in spectacular fashion because they educated themselves. But such records are not only of the past. There are many leading men in public life and industry today who attained their high positions through self-education.

Anyone who does not take time out of his day to improve his professional knowledge by reading is as shortsighted as the woodsman who does not periodically sharpen his axe. No time to read? No one can afford not to read! In the words of Sir Francis Bacon, "Reading Maketh the Full Man."

Charles O. Herb

EDITOR

Do you really know the alloys you buy?

For instance, are you SURE of:

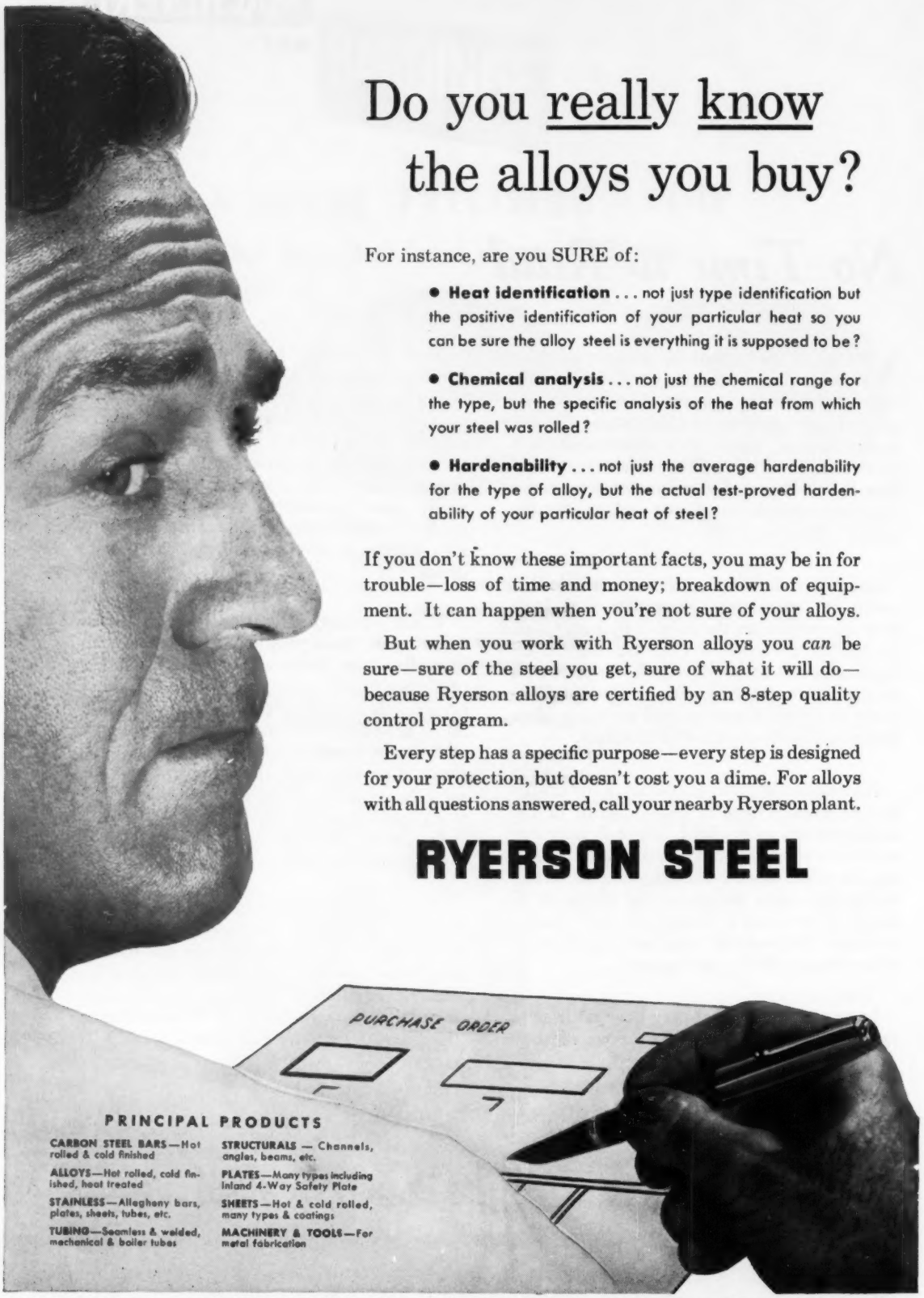
- **Heat identification** . . . not just type identification but the positive identification of your particular heat so you can be sure the alloy steel is everything it is supposed to be?
- **Chemical analysis** . . . not just the chemical range for the type, but the specific analysis of the heat from which your steel was rolled?
- **Hardenability** . . . not just the average hardenability for the type of alloy, but the actual test-proved hardenability of your particular heat of steel?

If you don't know these important facts, you may be in for trouble—loss of time and money; breakdown of equipment. It can happen when you're not sure of your alloys.

But when you work with Ryerson alloys you *can* be sure—sure of the steel you get, sure of what it will do—because Ryerson alloys are certified by an 8-step quality control program.

Every step has a specific purpose—every step is designed for your protection, but doesn't cost you a dime. For alloys with all questions answered, call your nearby Ryerson plant.

RYERSON STEEL



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A new concept in building an important machine tool involves production-line methods

Mass Production of Machine Tools

By EDGAR ALTHOLZ
Associate Editor

THE inconsistency of the handicraft approach to the building of a machine tool—itself, the virtual cornerstone of mass production—is on its way to correction. Credit for the first real departure from the traditional tailor-made techniques of machine tool construction goes to 123-year-old Brown & Sharpe. For the major operations on its automatic screw machines, this company is in the process of creating a "little Detroit" out of a single-story structure on its Providence, R. I., site.

Three machining lines are busy turning out the bed, speed-case, and base for the new model of the popular "00" automatic. In other buildings, streamlined methods have been projected for manufacturing the smaller components—gears, shafts, spindles, slides, and turrets—as well as for assembling the complete machine tool.

Mass-production techniques instituted thus far apply to a limited number of parts, yet have already been instrumental in allowing delivery-time promises to be reduced noticeably. The goal of B & S—and this is in the foreseeable future—is to turn out a completely assembled "00" at a rate of one per hour. Plans to mass-produce all other sizes of automatics are beginning to crystallize.

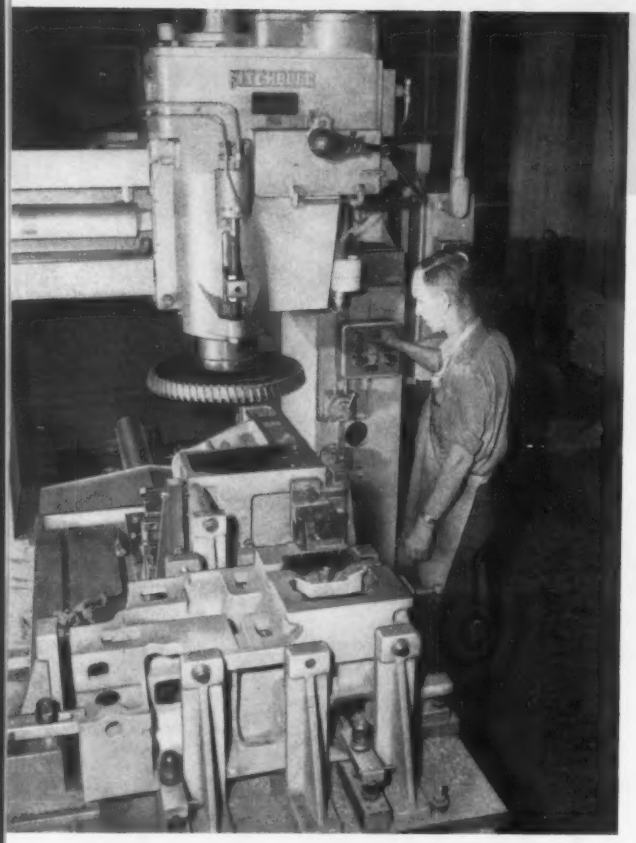


Fig. 1. A large, fine-pitch face mill machines the entire surface of the two screw machine beds in a single pass.

Next to be integrated in the major machining lines (scheduled for sometime this fall) is the "2G" screw machine.

Mass Production Permits Even Greater Accuracies

The improved competitive position, derived from reduced manufacturing time and costs, has been accompanied by an ability to work to still closer tolerances. In boring holes in the bed casting, for example, permanent multiple-spindle setups provide increased accuracies of diameters and center distances. This was not practical when holes were completed individually, by cutters and machines that had to be reset for each hole in each piece.

Highlights along the lines currently operating are shown in the accompanying illustrations. Building No. 10, designation for the new machining center, lies next to the company foundry. While still in the foundry, the beds, speed-cases, and bases are sanded and spray-painted, and housing interiors are sealed. Completing this work prior to machining, eliminates the need to mask finished surfaces later.

Upon entering Building No. 10, the castings are loaded on a power roller conveyor and forwarded to a large air-actuated turntable. Radiating from the turntable are separate roller conveyors for each machining line, to which the castings can be quickly shunted. For the beds, initial machining consists of milling top and bottom surfaces.

As can be seen in Fig. 1, two beds are worked simultaneously—the top of one and the bottom of the other—on a Fitchburg planer type milling machine. Roughing and finishing cuts are taken, the positions of the two beds then are interchanged, and the procedure is repeated. No layout is required, even though this is the first operation on a casting. This is made possible by locating and supporting the beds trunnion-fashion on heavy tapered plugs, called targets, which center in cored holes in opposite walls.

The sixty-six-blade Wesson insert type carbide face mill used has a diameter of 22 inches, sufficient to span all of the work surface. An integral hydraulic system powers the table. Also available, although not used for the operation, is a hydraulic feed for the head on its cross-slide.

A feature of the hydraulic system is a small cylinder, seen mounted on the front of the head of the milling machine. At the start of the rapid-traverse return stroke of the table, this device automatically raises the spindle slightly, preventing any drag of the cutter over the machined surface. At the end of the stroke, the spindle is automatically lowered to a positive stop. (For the roughing cuts, a shim is inserted over the stop to keep the cutter above the finished size.)

A team of two Natco three-way machines, into which elaborate fixturing has been engineered, drastically reduces time for completing the various holes in the bed. There are eighteen holes involved which require either drilling, core-drilling, boring, or reaming. Two beds are handled simultaneously on each machine, one doing the roughing and the other, the finishing. Cutting time for both beds on each machine amounts to only seven minutes, in contrast to the four and one-half hours required for one bed when jigs were used to machine the holes individually.

One of the machines (in this instance, the one used for finishing) is shown in Fig. 2. The beds are nested in each side of the fixture and secured by lever-operated clamps. To keep the locating

points in the fixture free of cast-iron chips, the pads on which the work rests each have a small hole. As the work is being lowered into position, the operator depresses a treadle valve which directs a jet of air through the holes, freeing the pads of all chips.

Tools in the left- and right-hand heads of the machine are piloted in bushings in the sides of the fixture. Those in the rear head are longer and are piloted in bushings in the front of the fixture. Several of the bars in the rear head perform line-boring operations, and consequently receive additional support by bushing brackets, called leaves.

In Fig. 3 is a close-up view of the fixture showing the right-hand leaf tilted up. The leaves are counterweighted and are raised for loading and unloading. When lowered, they are locked in position by shot-bolts. Because the line-boring bars in the finishing machine must pass through the rough-bored holes in the beds and engage the bushings in the leaves and front of the fixture before machining starts, some unusual features had to be incorporated in the design of the rear head and fixture.

Ingenious Arrangement Lets Boring Bits Enter Rough-Bored Holes

Rotation of the spindles in the head is synchronized and the bars are made to stop with the boring bits always in an "up" position. One of the bars is shown in Fig. 4. This is a view looking into the back of the fixture. After the work is nested and the leaves are lowered, the head is advanced with the spindles still not rotating and the bars enter their respective bushings. To afford clearance for the boring bits, which necessarily project above the bars, each bushing has a channel milled along the upper part of its bore.

It is essential, of course, to provide a means of permitting the boring bits to clear the rough-bored holes in the beds while the bars move into position. This is done through a mechanism that raises the pads supporting the beds about 0.070 inch until the bars are in position. To actuate the mechanisms, the operator changes the engagement of a lever with a quadrant (seen in Fig. 2) on the front corners of the fixture base.

There are a number of other interesting features of these Natco three-way machines. Lamps light up to signal safe operation of the units only when the beds are properly nested. Boring-bars are equipped with Stellite wear strips, and all are continuously lubricated during the cycle from a central drip system. For a large taper reamer in the rear head which starts to cut upon termination of the line-boring, spindle speed is automatically reduced from 240 to 45 R.P.M. Small plates, numbered in sequence, are riveted to the fixture near each clamp, lever, and handwheel that must be operated each cycle.

At another point along the bed line, four Master lathe-converter attachments grouped on a table perform a series of milling operations. The set-up shown in Fig. 5 eliminates the four sep-

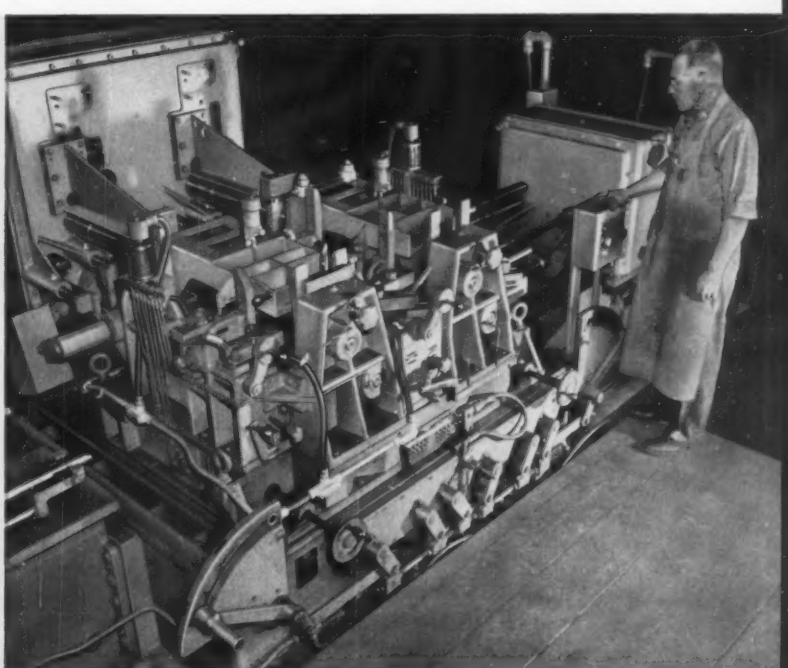


Fig. 2. Finishing operations for rough-bored holes in the bed walls are performed simultaneously on this three-way machine. A similar machine is set up for the roughing operations.

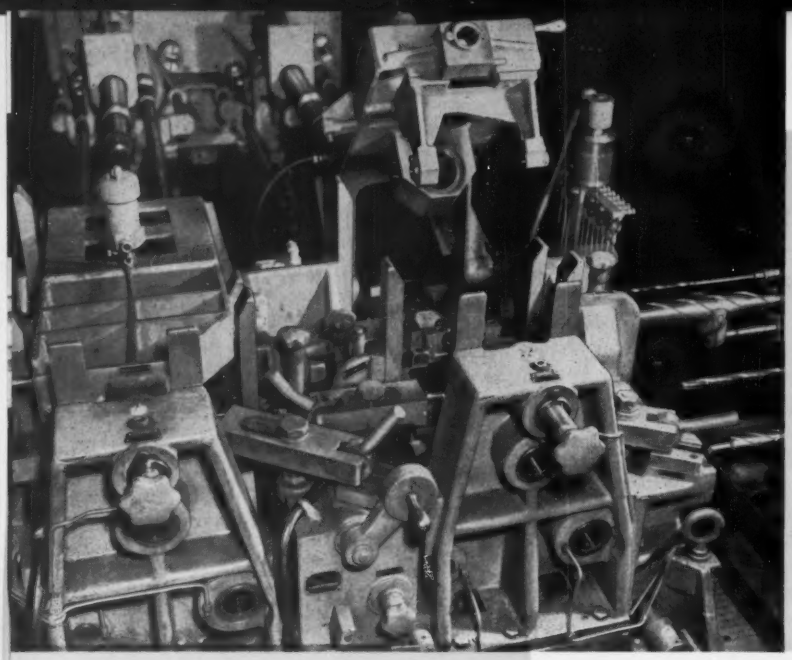


Fig. 3. One of the leaves of the three-way machine is shown in raised position. When lowered, the bottom of the leaf enters an area between internal cores of the work and serves to support a boring-bar.

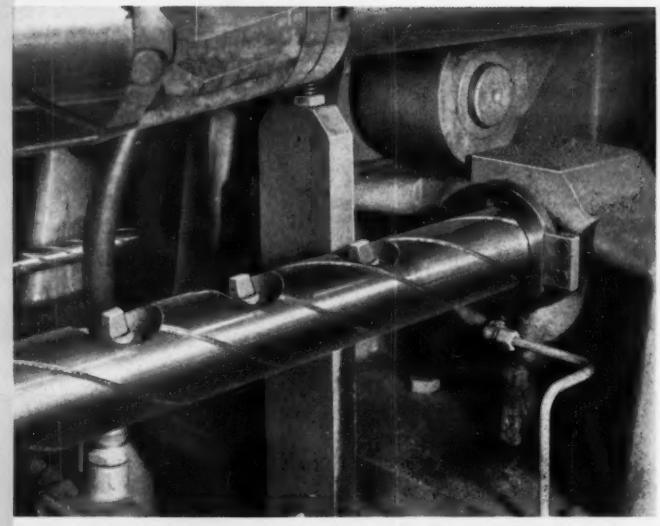


Fig. 4. When the rear-head spindles are not rotating, cutters are in an "up" position, in line with the channels in the bushings.

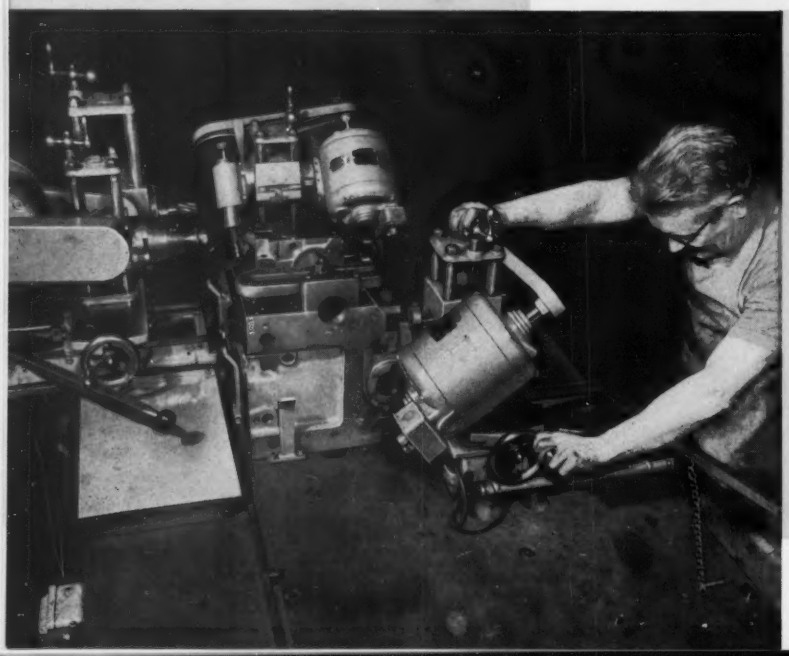


Fig. 5. Four lathe-converter attachments surround the work on the table and rapidly complete a series of small milling operations.

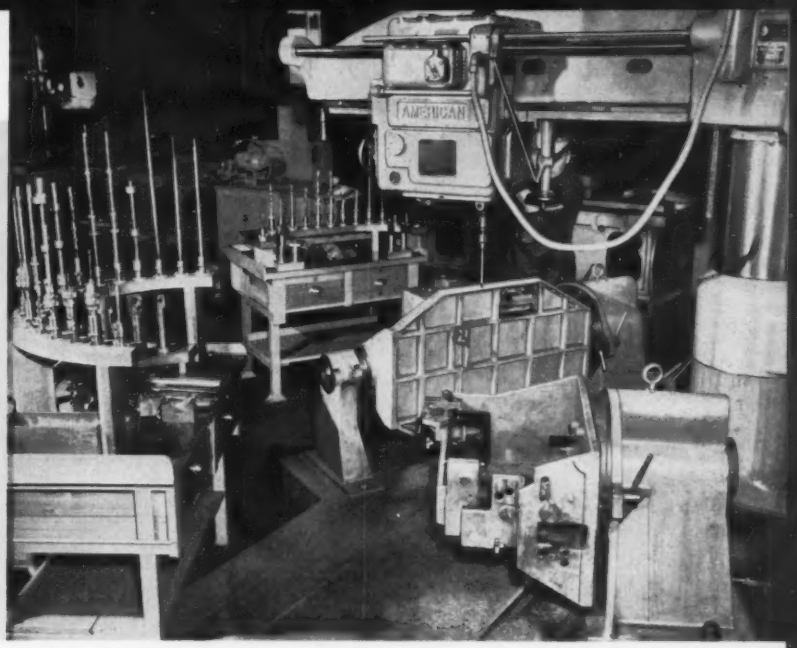


Fig. 6. Cutting tools for the radial drilling machine are neatly arranged in sequence in portable hardwood racks. Here, a rack is located adjacent to each of two drilling operations being performed on the bed.

arate handlings required with a conventional milling machine. Two of the heads, set at an angle, end-mill angular surfaces; another mills the top of a boss; and the fourth, an oil-groove in the turret-slide seat.

Beds are quickly lowered over a clamping post on the center of the table and positioned against fixed banking points. The attachments have integral slides, over which they are fed rapidly by a handwheel or quick-acting lever. One operator quickly "makes the rounds," completing the angular milling in sequence. Milling of the boss and the oil-groove is done at the same time, the heads for these operations sharing a common slide to facilitate the longitudinal location of each head.

Racks Hold Tools in Neat Fashion

Details like good housekeeping are paying off in accelerating production. A case in point is the tool-handling procedure seen in Fig. 6. Here, an American radial drilling machine performs two series of operations on the bed. A trunnion fixture supports the work for each series. The machine base has an angular extension, so that both fixtures can be permanently set up. Near the fixtures, all necessary tools are conveniently arranged in horseshoe-shaped wooden racks in the order in which they are used. When the machine is required for other production, the racks are removed and others substituted.

Activities along the speed-case line are illustrated in Figs. 7 to 11. The speed-case, located in the base compartment of the screw machine, houses the shafts and pick-off gears which set up spindle speeds. Initial machining is done on the Bullard vertical turret lathe seen in Fig. 7. Combined cuts from the turret and side-head finish both faces of the flanged front of the case. As in

Fig. 7. First machining operation on the speed-case line consists of combined cuts on the two faces of the flange.

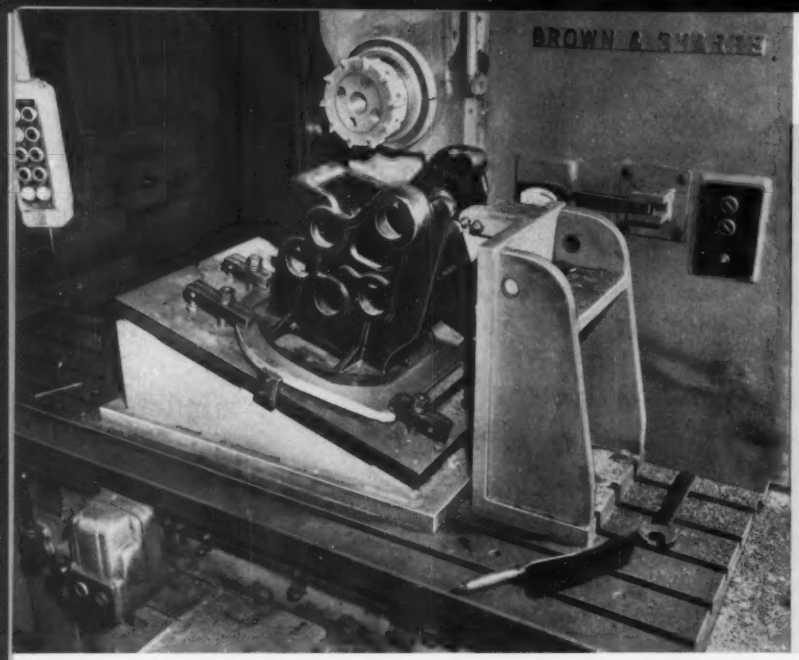


Fig. 8. Supporting the work on an incline eliminates profiling, since it is possible to face all cores in a down- and-up feed-stroke.

the first operation on the bed, location is made from targets in the fixture which enter cores in the speed-case.

Facing the cores is done on a bed type Brown & Sharpe milling machine, Fig. 8. By supporting the work on an incline, it is possible to face all the cores in a single down-and-up feed-stroke of the head.

The most elaborate machine tool on the speed-case line is a Natco "Holesteel," which drills, reams, and taps various holes in two surfaces of the work. A hydraulic table shuttles the work-fixture between three positions. In the first position, the work is loaded and unloaded, and one hole is drilled. In the second position, twenty-three holes are drilled and countersunk from a horizontal head, and twelve holes are drilled and countersunk from a vertical head. Tapping is performed in the third position from a horizontal head and a vertical head having lead-screw feeds.

Plugs Disappear into Table

The heads and the table are controlled from three push-button panels seen on the side of the machine, Fig. 9. In the illustration, the operator is shown manipulating two levers which set up a positive stop and lock for the table in each position. In Fig. 10—a view of the other side of the drilling machine—the table is shown in the second position against a stop plug projecting from the bed. When the table is to be shuttled to another position, the stop plug is retracted by manipulating one of the levers.

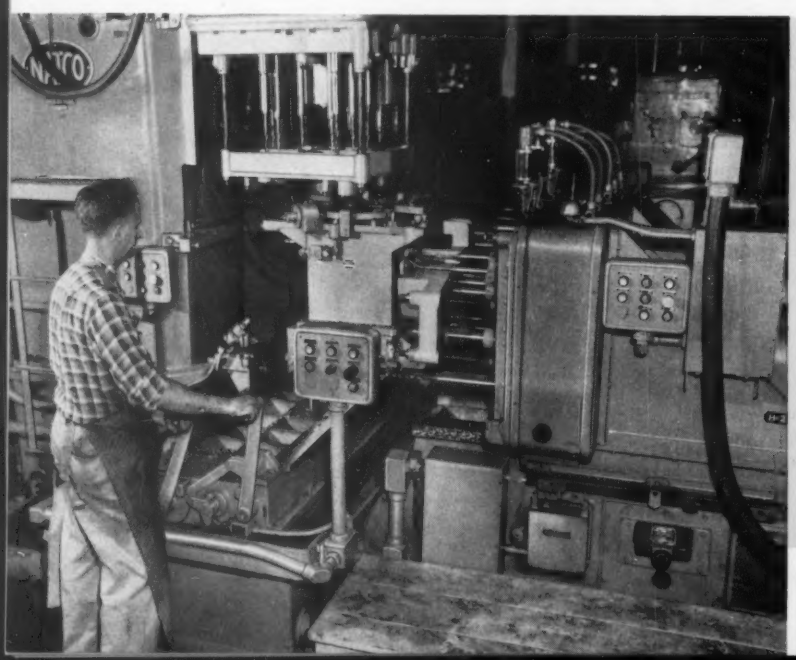


Fig. 9. For loading, drilling, and tapping, the table of the machine shuttles hydraulically. All movements are directed from three push-button panels.

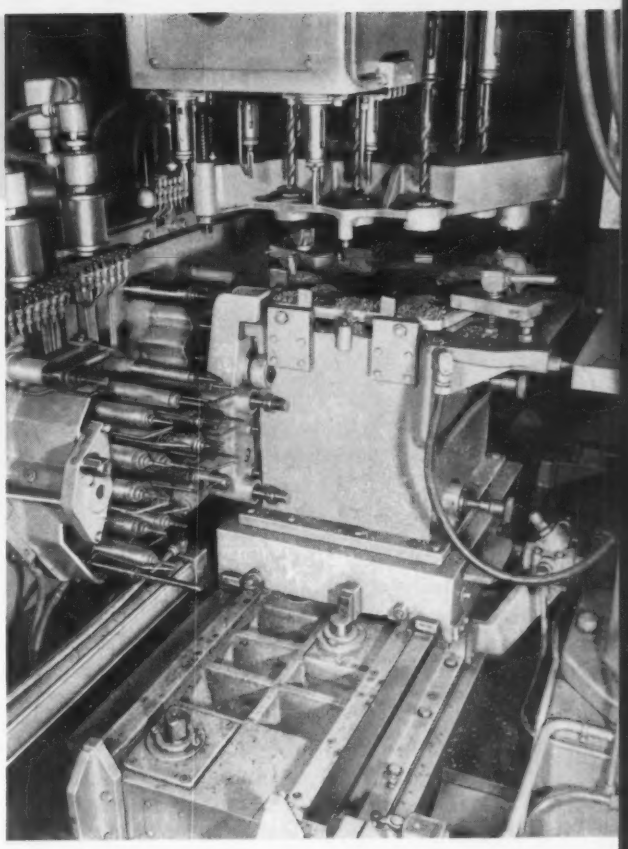


Fig. 10. Before the table starts its shuttle movement, the stop plugs and locating plugs are depressed into the bed of the machine.

By manipulating the other lever, a locating plug in the bed can be engaged with a close-fitting bushing in the under side of the table. (The locating plug for the third table position can be seen in the foreground near the left-hand corner of the bed.) Both levers are interlocked with the table hydraulic system, so that stop plugs and locating plugs are depressed before the table is able to shuttle.

Other features in the design of the machine include automatic braking and reversal of the taps, and an automatic spray lubrication of the taps as they start to cut. Also, the electrical circuit for the head motors will not close until the fixture is correctly loaded.

Cores in the speed-case are machined in a double-ended Heald "Borematic" equipped with a work-fixture having automatic locating and clamping features. In Fig. 11, part of a completed work-piece is visible above the fixture. When a new work-piece is nested in the fixture, hydraulic pistons move laterally to force it firmly against two banking surfaces. Next, four finger-clamps on top of the fixture, and one inside, pivot through a steep helix to secure the work. Then clamps are actuated hydraulically from a push-button panel on the machine. As a safety feature, sequence switches prevent the machine from running before the work-piece has been clamped.

Representative of the high-production equipment found on the base line, newest to be implemented, is the bed type Fitchburg milling machine seen in Fig. 12. Here, top and bottom of

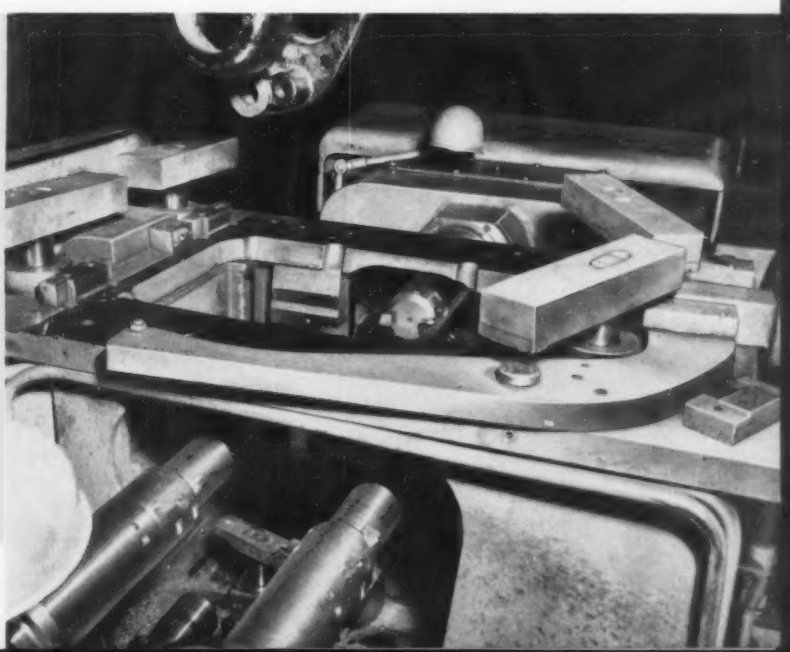


Fig. 11. When the speed-case is in position in the fixture, hydraulically actuated finger-clamps pivot around and through a steep helix to secure the work.

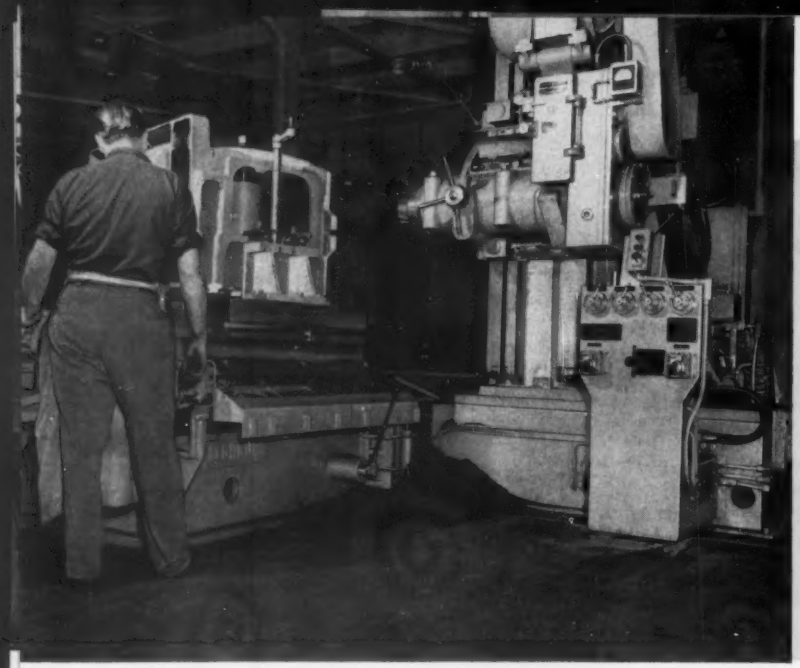


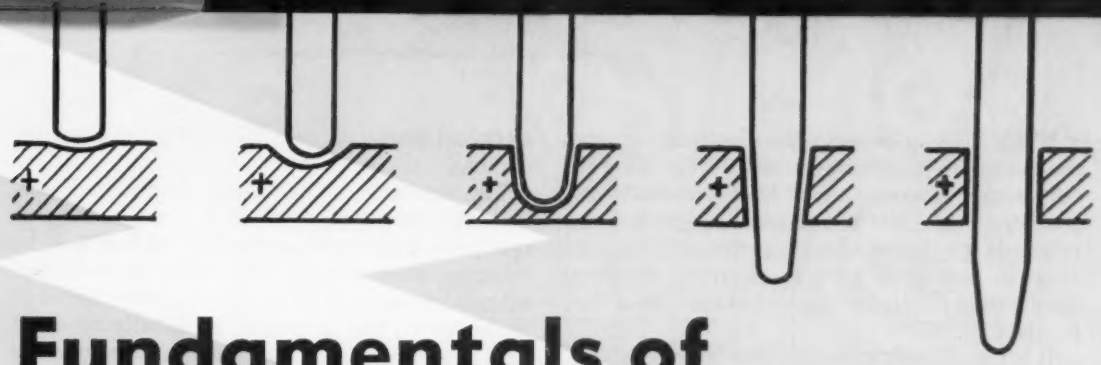
Fig. 12. The operator rotates the table 180 degrees from a control panel. Table must be fully retracted before it can start its movement.

the bore are face-milled. The work is held on a rotary indexing table (shown in the process of turning 180 degrees) so that both surfaces can be presented to the cutter in a single setting. Both the feed and indexing of the table are accomplished hydraulically. To prevent the work from striking the cutter during indexing, the hydraulic valve controlling the rotary table is automatically locked, except when the table is fully retracted. The head of the machine is counterweighted and is rapidly positioned and locked by a Denison hydraulic control system.

Production lines for other components for the automatic screw machine will soon complement the three now in full operation. One of them, for the drive-shaft bracket, is partly set up. In the heading illustration, a Heald "Boromatic" is at work machining the cores of the bracket. The brackets are handled in designated lots—all cores are rough-bored, then, after a tool change-over, all are finish-bored. To expedite handling, both ends of a horseshoe-shaped conveyor terminate at the machine.

The view of the ceiling above the machine, Fig. 13, shows one of the brackets in transit. The work-piece has been rough-bored, and will make a second trip around the conveyor before it is finish-bored. Air hoists are used extensively in the plant to pinpoint work on conveyors or in fixtures. In designing the production lines, curved monorails have been installed wherever necessary, so that the work can be raised and lowered in a straight line and without being tilted in order to clear some obstruction.

Fig. 13. Air hoists figure prominently in moving castings along production lines. Here, a drive-shaft bracket is shown in transit after leaving a boring machine.



Fundamentals of Electrical Discharge Machining

Fundamental information about the electrical discharge process, based on translations of Russian technical papers and operations being performed at various industrial plants in the U.S.S.R. This process is widely used in Russia to supplement, and sometimes even replace, conventional machining methods. A promising new application is the hardening of metals. First of two installments

ELECTRICAL discharge machining — or electro-spark machining, as it is sometimes called—is based on the principle of electro-erosion. Metal is removed by directing a series of electrical discharges across a dielectric gap between a tool having negative polarity and the work having positive polarity. The tool, shaped to the contour of the hole desired, duplicates its contour in the work-piece. Although several theories have been advanced on the actual metal removal phenomena, there is evidence that fracture occurs mechanically, due to electrostatic forces—without melting, burning, or oxidation.

To perform electrical discharge machining, it is necessary to provide an electrical circuit in which the part to be machined and the tool are the electrodes between which the discharges pass. Actually, two circuits, as shown diagrammatically in Fig. 1, are required: a discharge circuit consisting of a series of condensers C mounted parallel with the electrodes O (tool) and P (work-piece); and a charging circuit for periodically recharging the condensers. The charging circuit includes a direct-current source (such as the generator G) a variable resistor R_c, and the condensers C.

During discharge machining, metal is removed from the electrodes, thus increasing the distance between the tool and work. To maintain machining continuity, the electrodes must be fed together to maintain the necessary gap. Otherwise, the gap would become so great that the electric field applied would be insufficient to form a discharge, and metal removal would stop. Also, the rate at which the electrodes are fed together must be closely controlled, with relation to the amount of metal removed, to prevent bringing the tool in contact with the work, or exceeding the maximum gap allowable.

As can be seen from Fig. 1, the current of the charging circuit is dependent upon the current of the discharge circuit. Average values of the current, voltage, and resistance of the discharge circuit are determined by the gap between the electrodes. When the electrodes are in contact, the short-circuit current is determined from the formula:

$$I_{c/c} = \frac{U}{R_c}$$

where

$I_{c/c}$ = short-circuit current;
U = applied voltage;
R_c = resistance of the charging circuit.

When the gap between the electrodes exceeds the maximum permissible value, the charging circuit current becomes zero. At intermediate gap positions, from zero to maximum, there is a corresponding value of charging current. This variation in current is used in electrical discharge machines to determine the automatic rate of feed for the tool.

It is not difficult to make a regulator which will react to variations in the charging current and change the position of the tool. Existing regulators can be classified as either of the electromagnetic or motor types. Fig. 2 shows diagrammatically a set-up having an electromagnetic regulator with a solenoid. Circuit *A-O-P-B* creates the electrical discharge, and *G-E-F-H* is the regulator circuit.

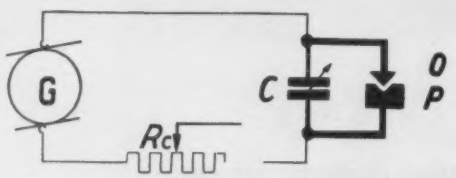


Fig. 1. Schematic diagram of a set-up for electrical discharge machining, with the negatively charged tool seen at (O) and the work-piece at (P).

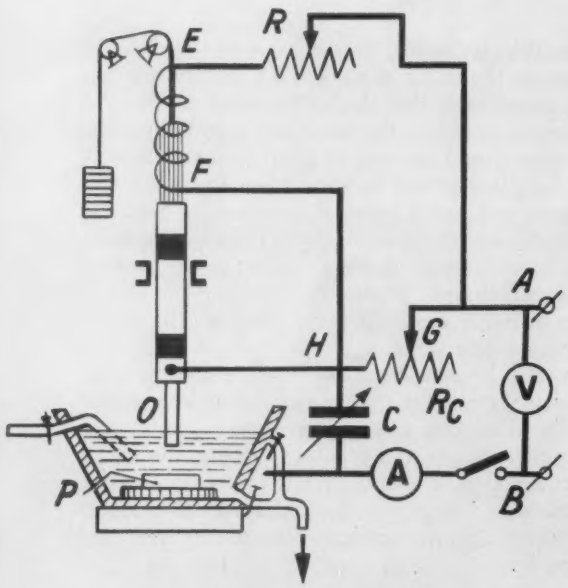


Fig. 2. Tool (O) is carried on the lower end of the solenoid core, which is counterbalanced. Work-piece (P) rests on bottom of a fluid-filled tank.

The regulator circuit contains a solenoid with its center core, a resistance R to regulate the current passing through the solenoid, and part of the charging resistance R_c. The lower part of the solenoid core is an arbor for carrying the electrode tool *O*, and its weight is partially balanced by a counterweight. When the distance from the tool to work-piece *P* exceeds the maximum allowable gap, there is no voltage drop in the charging resistance, and the solenoid is not energized. In such cases, the solenoid core is lowered by gravity until the tool contacts the work. Then, passage of current through the charging circuit causes a voltage drop across resistance R_c, thus energizing the solenoid and tending to lift the core. This pull and the lift afforded by the counterweight raise the tool until a gap is created which will permit a discharge. The system is self-balancing.

As the tool is shortened by erosive action on the metal, the gap is increased, and the currents in the charging circuit and solenoid coils are decreased. This diminishes the pull on the solenoid core, and the tool will be lowered until the gap reaches its initial value. If the gap diminishes, due to excessive contamination by metal particles of the dielectric through which the discharge passes, higher currents flow through the charging circuit and solenoid coils. Thus, pull on the core is increased, and the tool is lifted to re-establish the necessary gap.

Characteristics of Electrical Circuits

The amperage of the charging current and the capacitance of the condensers are essential factors influencing the characteristics of electrical discharge machining. As previously mentioned, regulation of most machines is controlled by varying the current, with the voltage being maintained constant. Productivity, or the amount of metal removed in a given time, depends on the energy and the frequency of the discharges. The energy of an individual discharge, if losses in the condensers and wiring of the circuits are neglected, can be computed by employing the following formula:

$$W_d = \frac{CU^2}{2}$$

where

W_d = energy of discharge in joules;
C = capacitance of condensers in microfarads;
U = voltage between the condenser plates at time of discharge in volts.

The frequency of discharge is inversely proportional to the time required for the voltage of the condensers to build up to the breakdown

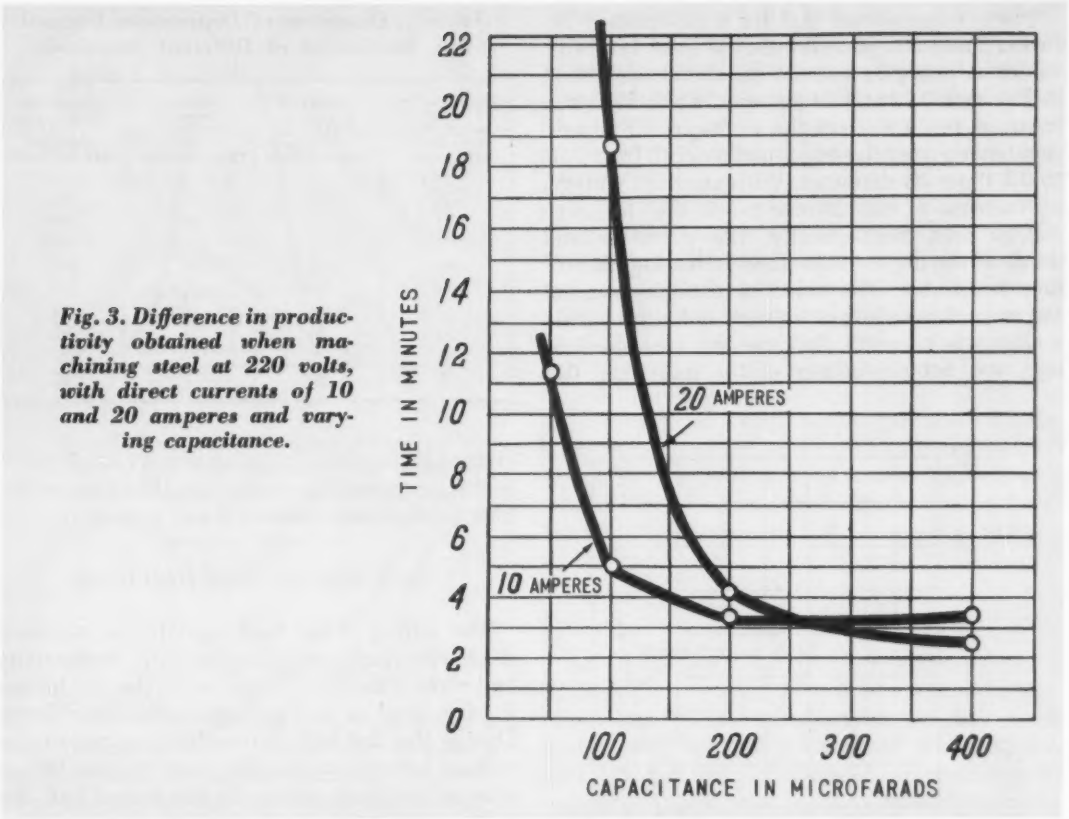


Fig. 3. Difference in productivity obtained when machining steel at 220 volts, with direct currents of 10 and 20 amperes and varying capacitance.

point at which discharge occurs. This can be expressed by the formula:

$$N = \frac{1}{t_a}$$

where

N = the discharge frequency;
t_a = the time required to build up discharge voltage in the condensers.

This time, t_a can be taken as equal to the full charging time t_c, which can be computed from the formula:

$$t_c = \frac{4.6\ CU}{I_{c/c}}$$

where C and U are the same as in the preceding formula, and $I_{c/c}$ equals the short-circuit current.

If the formula for t_c is substituted for t_a in the preceding equation, we obtain the following formula for the discharge frequency N:

$$N = \frac{I_{c/c}}{4.6\ CU}$$

Variation in productivity with relation to the capacitance is illustrated in Fig. 3. The two curves were plotted for operation at 220 volts, with one curve for 10 amperes and the other 20 amperes, when cutting a 5/16-inch diameter hole in steel with a copper-graphite electrode. It can be seen that the rate at which productivity is increased (by raising the capacitance) sharply decreases between 150 and 200 microfarads, and is practically zero when the capacitance exceeds 200 microfarads. This is explained by the fact that increased discharge energy decreases the frequency. As a result, it is considered unprofitable to increase the capacitance above 300 microfarads because of the small increase in productivity possible.

With the capacitance maintained constant, it is necessary to boost productivity by increasing the charging current. However, this can only be done within certain limits. For example, Fig. 4 shows the differences in productivity when varying the charging current in machining steel at 220 volts, with the capacitance held at 100, 200, or 400 microfarads. The time required for machining decreases rapidly as the amperage increases—up to a certain point, beyond which higher currents lengthen the machining time. This is caused by the greater formation of gas in the dielectric fluid with increased power, which periodically drives the fluid out of the working zone to break the stability of the cycle and lower the production that can be obtained.

Practice has shown that for a capacitance between 2 and 200 microfarads, the most favorable values of charging current for stable machining lie between 0.32 and 24 amperes. Each discharge forms on the surface of the work-piece a depression having irregular edges and a depth from 0.03 to 0.3 times its diameter. With constant voltage, an increase in capacitance raises the discharge energy and, consequently, the diameter and depth of the depressions—thus increasing the surface roughness. The value of charging current has much less influence on surface finish because a change in current only varies the area of coverage, and not the energy of the individual discharge. Even when the value of the charging current is increased five or six times, the effect on surface finish is very weak.

Table 1. Diameters of Depressions Formed with Discharges of Different Magnitude

Time, in Per Cent of Complete Charging Time from Start of Charge	Voltage of Charge, in Per Cent of Charging Circuit Voltage	Power of Charge, in Per Cent of Complete Charging Power	Diameter of Depression, in Per Cent of Maximum Diameter Possible
55	92	81	92
50	90	80	90
45	87	..	87
40	85	72	85
35	80	..	80
30	75	56	75
20	60	36	60
10	37	14	37
5	20	..	20

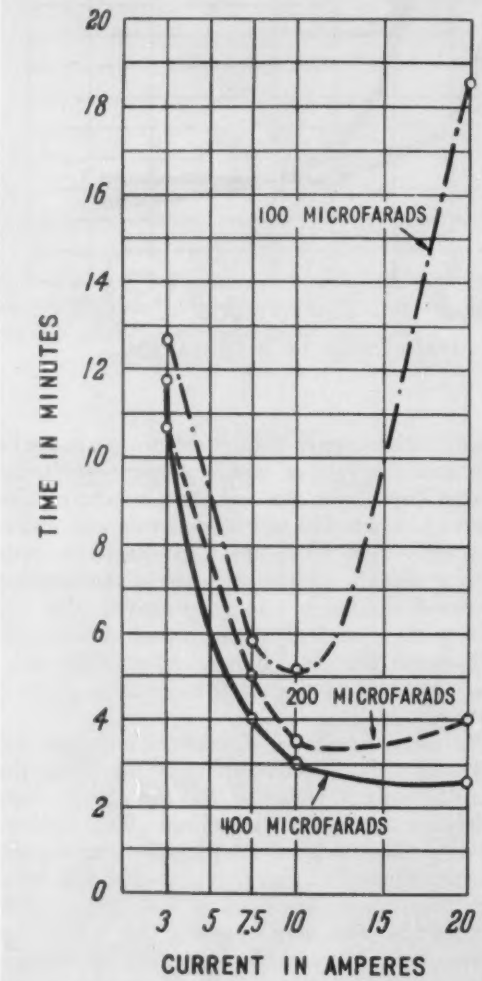


Fig. 4. Time required for machining steel at 220 volts varies sharply when the current is changed and the capacitance is maintained at 100, 200, or 400 microfarads.

Setting of the Feed Regulator

The setting of the feed regulator on electrical discharge machines influences both productivity and surface finish. Voltage rise in the condensers is very rapid at first and gradually slows down. During the first half of the charging period, the voltage between condenser plates reaches 90 per cent of the input voltage. In the second half, the voltage increases only 9 per cent more.

If the distance between electrodes (tool and work-piece) is set to allow the condensers to discharge at a voltage equal to 85 or 90 per cent of the input voltage, the number of discharges can be increased considerably. Furthermore, even with the lower power of the individual discharges, the speed of metal removal is increased. When the charging current is stable, productivity varies according to the gap, as seen in Fig. 5, and maximum productivity corresponds to the optimum gap, which is much lower than the maximum sparking distance.

Reducing the magnitude of the individual discharges reduces the diameter of the depressions formed, as shown in Table 1, and consequently gives a better surface finish. As the gap passes from minimum to maximum, the surface roughness increases. On the other hand, as the gap decreases, the surface finish will improve. Therefore, the feed regulator should be set so that the gap will be equal to, or slightly less than, the optimum.

A correct setting can easily be checked because a regular discharge will produce a continuous hum. Also, the readings of the voltmeter and ammeter will not change. Normally, the working current must be 60 to 70 per cent of the short-circuit current.

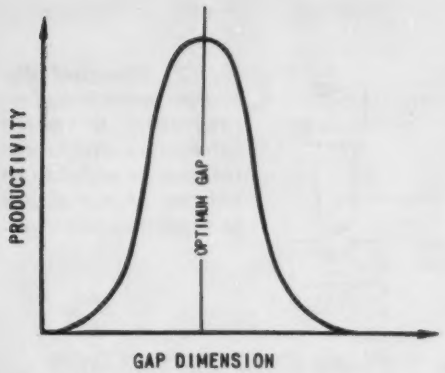


Fig. 5. Productivity varies according to the gap between tool and work when the charging current is stable. Optimum gap is less than maximum sparking distance.

Electrode Materials

The materials from which the electrodes are made also influence the productivity and surface finish obtained in electrical discharge machining. Effect of heat on the work-piece and tool is of major importance, while hardness and other mechanical properties of the electrode materials are relatively insignificant. For example, hardened steel is machined more easily than mild steel.

Machining action on the work-piece (anode) depends largely on the distribution of energy between the two electrodes at the instant of discharge. With the anode material fixed, the energy absorbed by the work-piece can be considerably modified by changing the tool material, thus affecting productivity. Fig. 6 illustrates the relative productivity when machining steel with tools of various materials. This comparison is based on a value of 1 for a brass tool containing 40 per cent zinc.

Sizes of the particles removed will vary with the materials from which the electrodes are made, even though the discharges are of identical energy. As a result, surface finishes can be different under the same machining conditions. For example, in machining steel with a brass tool a surface finish of 6 microns (0.0002 inch) was produced. However, when machining under the same conditions with a copper-graphite tool, the surface finish obtained was 8.1 microns (0.0003 inch), but the production rate was higher. Metals that are more machinable with this process will have a rougher surface finish than metals that are less machinable.

Working Fluids

All known spark machining operations (except hardening) are done in a fluid to prevent particles from sticking to the working surface of the tool, and to increase the process of electro-erosion. Practice has shown that best results can be obtained with organic liquids (such as kerosene, transformer oil, or mineral oil), or, in certain cases, water. Table 2 illustrates that productivity, which is approximately the same for the three organic liquids, is considerably less when using water as the working fluid. This is caused by the high conductivity of water which results in incomplete charging of the condenser. Also, with water, there is a loss of energy to processes other

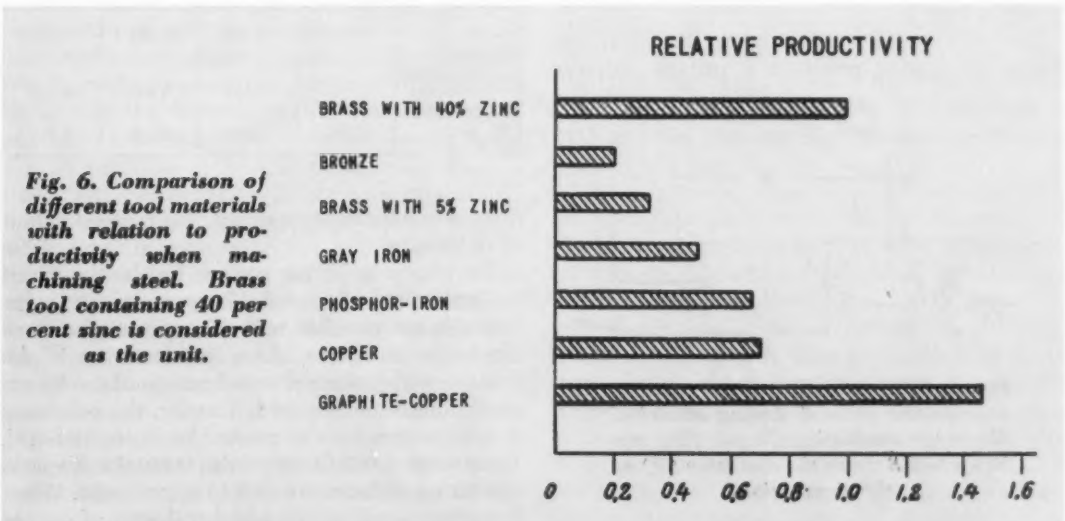


Fig. 6. Comparison of different tool materials with relation to productivity when machining steel. Brass tool containing 40 per cent zinc is considered as the unit.

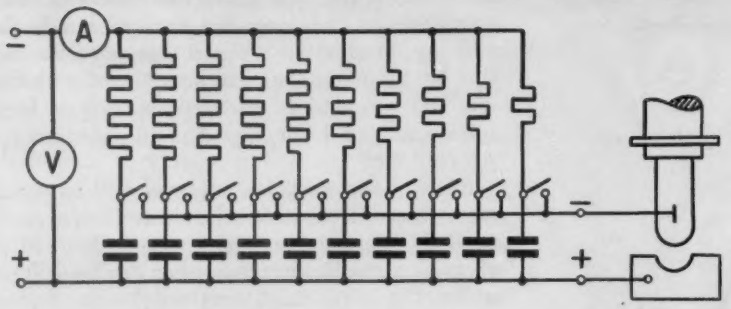


Fig. 7. Electrical discharge machining arrangement in which condensers and resistors can be added to or cut out of the circuit to regulate operations.

than machining, such as electrolysis. Results in Table 2 were obtained when machining steel with a brass tool. Surface finishes produced with the three organic fluids are practically identical. In drilling deep holes, low-viscosity fluids should be avoided, and kerosene is recommended. Since the use of kerosene alone may present a fire hazard, a mixture of 50 per cent kerosene and 50 per cent of either transformer or mineral oil is sometimes employed.

Effect of Electrical Characteristics on Productivity

Electrical characteristics used for rough, semi-finish, and finish machining are listed in Table 3, and the maximum productivity with each type of machining operation is given in Table 4, based on the cutting of steel with a brass tool. In most industrial installations, the charging circuit voltage is maintained constant at 110 or 220 volts, and regulation is accomplished by varying the capacitance and the charging resistance. One arrangement in which condensers and resistors can be added to or cut out of the circuit is illustrated in Fig. 7.

The way metal is removed in electrical discharge machining produces a surface different from that obtained by any mechanical means. Each discharge pulls a metal particle from the surface of the part, leaving a concave depression which is up to 0.3 times as deep as its diameter. During machining, the work surface becomes covered by a multitude of these depressions, which overlap each other as seen in Fig. 8. Under continued action of the discharge, metal is pulled from the edges of the depressions and uniformly deforms their contours. Therefore, the finish of a spark-machined surface is determined by the geometrical dimensions of the depressions, the degree to which they overlap, and by the amount of deformity.

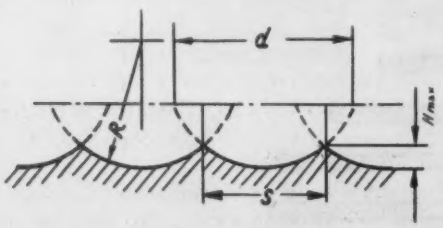


Fig. 8. Schematic diagram of concave depressions formed during electrical discharge machining. Depth (H) can be up to 0.3 times the diameter (d) of the depression.

Table 2. Relative Productivity of Electrical Discharge Machining when Using Different Working Fluids

Working Fluid	Electrical Operating Characteristics			
	270 Volts, 27 Amperes, 250 Microfarads		270 Volts, 13 Amperes, 94 Microfarads	
	Productivity, Cubic Inch per Minute	Depth of Hole, Inch	Productivity, Cubic Inch per Minute	Depth of Hole, Inch
Kerosene	0.009	0.189	0.004	0.366
Transformer Oil	0.010	0.189	0.004	0.370
Mineral Oil without Sulphates or Calcium	0.010	0.189	0.004	0.374
Water	0.005	0.106	0.001	0.181

To obtain a better surface finish, the input voltage must be lowered. However, voltage regulation is not possible with all types of electrical discharge machines. Also, productivity is decreased with lower voltages because of the longer machining time required. Usually, the efficiency is not enough for the process to be economical. Even when a satisfactory finish is obtained, spark-machined surfaces are dull in appearance. When it is necessary to obtain a higher degree of surface

Table 3. Electrical Characteristics for Rough, Semifinish, and Finish Machining

Operation								
Rough Machining			Semifinish Machining			Finish Machining		
Voltage, Volts	Current, Amperes	Capacitance, Microfarads	Voltage, Volts	Current, Amperes	Capacitance, Microfarads	Voltage, Volts	Current, Amperes	Capacitance, Microfarads
150 to 200	15 to 30	150 to 500	100 to 150	5 to 15	30 to 150	30 to 90	0.2 to 1	0.25 to 15
....	....	....	100	30	600	100	3	10
....	....	....	100	15	200	100	0.25	2
220	40	500	220	8	100	220	0.4	6
220	24	300	220	4	50	220	0.32	4
220	16	200	220	2.4	30	220	0.16	2
....	....	....	220	0.8	10	....	....	....
100 to 150	10 to 30	400	40 to 100	2 to 10	40	20 to 40	0.1 to 2	4
200 to 250	12 to 50	200 to 300	100 to 200	5 to 12	100 to 300	100 to 500	3.5	30 to 100

finish, electrical discharge machining can be combined with mechanical machining.

Methods identical to those used for mechanical metal removal processes can be employed to find the degree of finish of a spark-machined surface. A rough- or semi-finished surface can best be observed with a binocular microscope. For finished surfaces, instruments such as the Profilometer, Surfindicator, or interferometer can be used.

Table 4. Maximum Productivity Obtained with Rough, Semifinish, and Finish Machining

Operation	Productivity, Cubic Inch per Minute
Rough Machining	0.009 to 0.020
Semifinish Machining	0.001 to 0.009
Finish Machining	Up to 0.001

Heat, created during the discharges, partially melts and evaporates a certain amount of metal. This causes an instantaneous drop in temperature which produces some tempering of the external surface at the location of the discharge. Such phenomena form a whitish surface layer having a high hardness as well as wear and corrosion resistance. Furthermore, it has been established that fatigue resistance of a part having such a white layer is improved.

This type of change in the metal structure results in hardening of mild steel, and secondary hardening and annealing of hardened steel. When machining hardened steel by the electrical discharge method, the whitish surface layer has a hardness superior to the base metal. In the case of mild steel, the hardness of the surface layer is somewhat lower than that obtained with hardened material. This is due to the speed of the process, in which the metal is at the critical temperature an insufficient length of time to permit complete transformation.

Thickness of the whitish layer varies with the speed of machining and the working fluid used, and is usually from 0.004 to 0.0016 inch. Under this superficial layer is an annealed layer from 0.012 to 0.016 inch thick.

In the second and concluding installment of this article, factors affecting the precision of machining, materials used for tools, methods of increasing production, and techniques employed in drilling by means of the electrical discharge method will be discussed.

* * *

Zinc Industry Celebrates its First Million-Ton Year

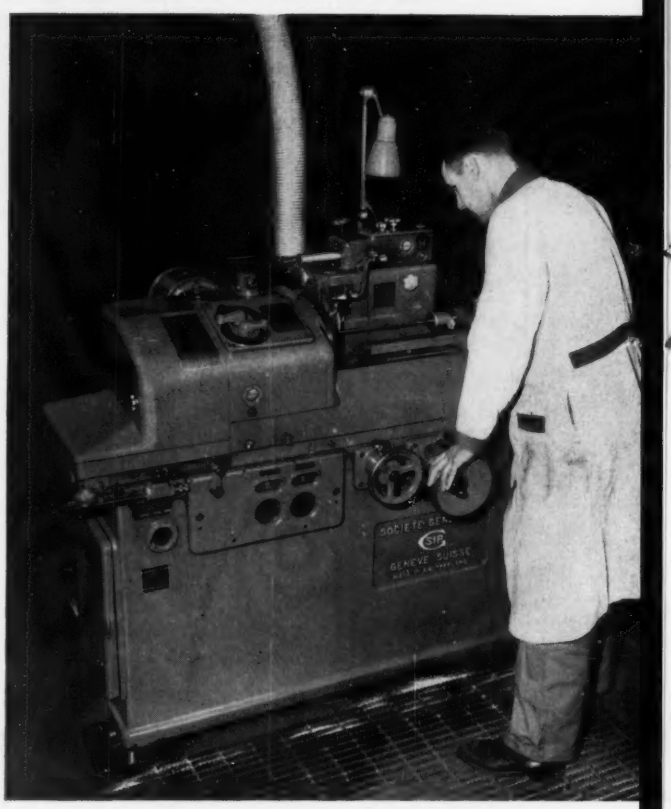
Domestic production of slab zinc in 1955 broke all industry records. The American Zinc Institute estimates that the final figures for smelter production for 1955 will prove to have exceeded 1,025,000 tons, while smelter shipments for the same period are estimated to have gone over 1,100,000 tons. Figures show that the previous high peacetime production was 971,191 tons in 1953 and the previous high wartime production was 971,873 tons in 1943.

The galvanizing industry was the largest consumer of slab zinc during 1955 with an estimated 430,000 tons consumption. The die-casting industry was second with an estimated 380,000 tons of slab zinc consumed.

Production of zinc in rolled form was estimated to exceed 53,000 tons. Zinc in the form of sheet, strip, and plate has a great variety of uses, the largest being for the production of dry batteries. Large quantities of zinc are also used in the manufacture of such products as fruit jar caps, weather strip, eyelets and grommets, laundry and dry cleaning tags, organ pipes, and novelties.

Precision Lead-Screws Ground from the Solid

By M. C. SULANDER, General Manager
and W. F. SPIERLING, Engineer
Precision Thread & Gear Corporation
Chicago, Ill.



EXTREMELY accurate movements of slides on machine tools and scientific apparatus depend on precision lead-screws. For example, ruling engines, used to cut more than 30,000 fine parallel grooves to the inch in diffraction gratings for spectrographic analysis equipment, require ultra-precise lead-screws. In astronomical observations, the slightest inaccuracy in the lead-screw would result in errors of many miles. Scientific measuring instruments, toolmaker microscopes, and micrometer screws for jig boring machines and other equipment also demand screws made to very close tolerances.

Such precision lead-screws used to be made by accurately turning or milling the threads, followed by lapping with a mating nut, and leaving the part unhardened. However, such soft screws had a relatively short life because of rapid wear. Now, Precision Thread & Gear Corporation grinds the threads from the solid.

Carefully controlled heat-treatment, ultra-precise thread grinding, and thorough cleanliness have made it possible to produce lead-screws having a variation in thread pitch diameter not exceeding 0.0002 inch, and a maximum lead error between any two vees at 1-inch intervals of 0.0003 inch. Lead-screws having external thread lengths up to 16 inches, but not exceeding 19 inches over-all, and with a maximum diameter of 5 1/2 inches have been made.

Selection of the material from which the lead-screw is to be made is all-important. Very good results have been obtained with Sparta, a Universal Cyclops air-hardening tool steel containing about 1 per cent carbon, 0.60 per cent manganese, 0.20 per cent silicon, 5.25 per cent chromium, 0.25 per cent vanadium, and 1.10 per cent molybdenum. In rough-turning the bar stock, a minimum of 1/8 inch of stock is left on all surfaces for subsequent removal.

Prior to semifinish turning the bars, they are annealed to remove any stresses set up during rough machining. Annealing is performed by heating the bars slowly and uniformly to a temperature of 1500 degrees F. After soaking at this temperature for two hours, the bars are slowly cooled at a rate of 30 degrees per hour until a temperature of 800 degrees F. is reached. Then, to induce softness and improve the machinability, the parts are reheated to a temperature between 1200 and 1300 degrees F., soaked at this temperature for one and one-half hours, and cooled in air.

From 0.015 to 0.020 inch of stock is left on the lead-screw surfaces to be threaded after semifinish turning, the exact amount varying with the size of the lead-screw. The bars are then hardened by heating to 1750 degrees F. and cooling in still air at room temperature, resulting in a hardness between 54 and 56 Rockwell C. Stresses set up during hardening are relieved by tempering, consisting of heating to a temperature between 1000 and 1050 degrees F. and cooling in air.

Hardened and tempered bars are stabilized to complete the transformation of the retained austenite into martensite, and thus prevent dimensional changes which might take place over an extended period. Stabilization is accomplished by placing the bars in a refrigeration unit maintained at a tem-

perature of minus 120 degrees F. After allowing the bars to return to room temperature, they are retempered by again heating to approximately 1025 degrees F. and cooling in air. In addition to improving the dimensional stability in service, stabilization by cold-treatment provides a uniformly hard wearing surface. Also, better finish can be obtained, and grinding cracks are eliminated.

Approximately 0.010 inch of stock is removed from the periphery of the bar in an operation performed on a cylindrical grinding machine, leaving 0.005 inch of stock in excess of the required thread major diameter. Then the threads are ground in the hardened and stabilized bars on Sip high-precision thread-grinding machines such as the one seen in the heading illustration.

On these machines, the work is mounted between centers and the work-table is traversed by an ultra-precise lead-screw, having a pitch of 5 threads per inch and driven through highly accurate change-gears which connect it to the work-spindle. The grinding wheel carriage remains stationary during grinding. To allow for grinding square or buttress threads, the carriage can be swiveled through an angle of 15 degrees, about a vertical axis, to provide clearance for the wheel. Also, the grinding spindle can be tilted up to a maximum of 15 degrees in either direction from the horizontal to suit the helix angle of the thread to be ground. Feed of the wheel toward the work is controlled by a handwheel-operated precision screw and micrometer stop, permitting settings as close as 0.00005 inch.

A correcting device and temperature compensator are fitted to the machine lead-screw to insure close-tolerance grinding, and the lead-screw nut is connected to the bed by a universal joint to guarantee correct alignment. Also, the work-table is partly supported on spring-loaded rollers, which run in V-ways, to minimize friction on the guiding surfaces. The machines are set on rubber vibration-isolating pads in a thick concrete floor.

Vitrified-bond, aluminum-oxide abrasive wheels of 320 grain size, *K* grade, and No. 9 structure are used for thread grinding. These very fine grain wheels produce an exceptionally smooth surface finish, and eliminate practically any need for subsequent lapping of the threads. The wheels are originally 10 inches in diameter by 3/8 inch wide, and are rotated at 3000 R.P.M.—corresponding to a maximum cutting speed of 7850 surface feet per minute—while the work is revolved at 14 R.P.M. Prior to operation, the wheels are statically balanced by means of the set-up seen in Fig. 1. A stand is fitted with two hardened steel blocks used as rolling ways for the arbor on which the wheel is mounted and balanced. One of the three support points for the stand has an adjusting screw for leveling with a precision spirit level. The grinding wheels are stored horizontally, as seen in the background of Fig. 1, to prevent the cutting oil from collecting in one section of the wheel and causing unbalance.

Approximately four roughing passes and ten finishing passes are made in grinding the threads to the required depth, the exact number depending on the size and pitch of the thread. Truing of the grinding wheel is performed after practically every pass, by means of a single diamond which is maintained normal to the wheel surface in all positions. In this way, the shape of the diamond has no influence on the accuracy of the thread profile produced on the wheel.

The tangential type truing device is mounted at the back of the wheel carriage, on a slide moved along guide ways by a rack and pinion operated through a handwheel. The head which carries the diamond swivels on this slide, about a vertical axis. Angular motion of the head is limited by two positive stops, which are adjustable with relation to a circular slide graduated in degrees. A removable micrometer gage is used to set the diamond holder for the required radius to be ground at the roots of the threads. Sides of the wheels are successively dressed by back-and-forth movement of the diamond, and then the rounded nose is generated by rotating the head.

One of the finishing passes in producing a lead-

Fig. 1. Prior to thread grinding, the abrasive wheel and the arbor on which it is mounted are statically balanced on this leveling stand.

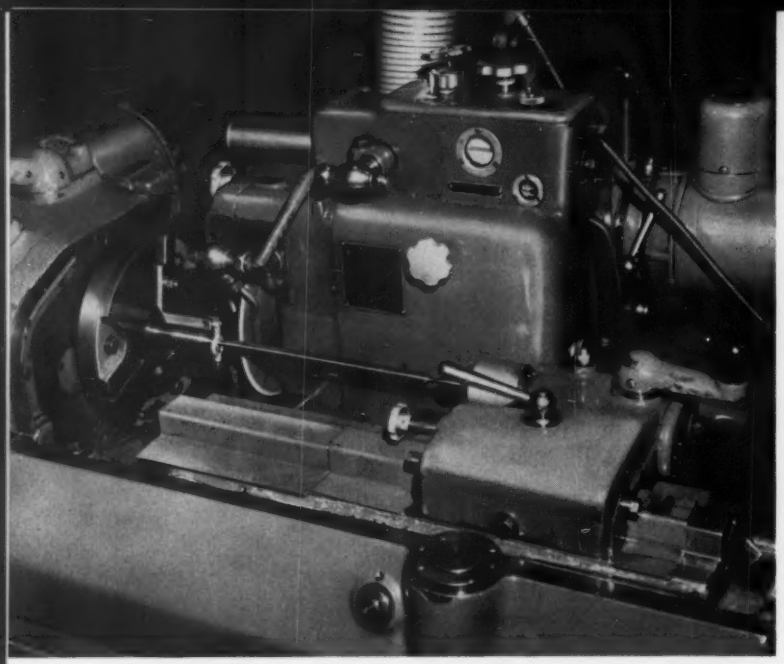


Fig. 2. Here, the 10-inch long thread on a precision lead-screw is being finish-ground. About ten passes are made in finish-grinding the threads to the required depth.

screw having a 10-inch long thread is illustrated in Fig. 2. This thread has a basic major diameter of 0.7500 inch, a pitch diameter of 0.6850 inch, and 10 threads per inch. Included angle is 60 degrees, and the rounded contour at the root of the thread has a radius of 0.005 inch. Variation in pitch diameter is held to 0.0002 inch maximum. Also, maximum lead error between any two vees taken at 1-inch intervals cannot exceed 0.0003 inch at 68 degrees F.

Threads on the lead-screw are inspected after each pass by means of Pratt & Whitney Supermicrometers and Jones & Lamson optical comparators. On the Supermicrometers, precision gage-blocks are used as setting masters, and Van Keuren wires—checked by the National Bureau of Standards—for three-wire thread measurements. With the comparator, Fig. 3, the lead-screw is mounted between a light source and a magnifying lens. The resulting shadow is projected on a viewing screen for comparison with a scribed glass chart showing required roots, crests,

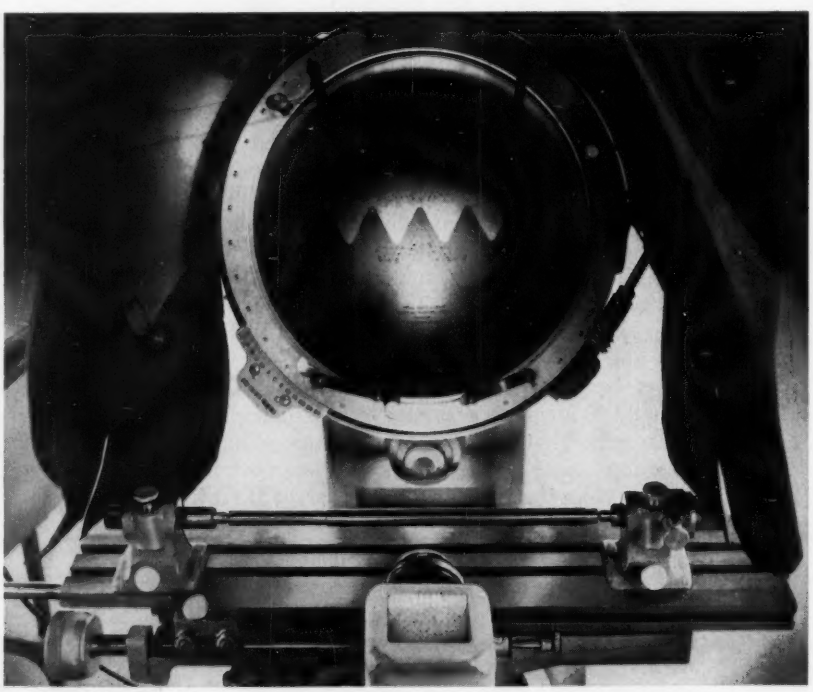


Fig. 3. Optical comparator is used to check the roots, crests, and V-forms of ground threads at various magnifications with lines that have been scribed on the glass chart.

Fig. 4. Measuring machine employed for final inspection of precision lead-screws. Here, measurements are being made over wires and checked on gage.

and V-forms for various pitch threads of the specified magnification. Magnification can easily be changed to 10, 20, 31.5, 50, 62.5, or 100 times size.

Any errors detected during inspection are automatically eliminated during subsequent passes by adjusting the correcting device on the thread-grinding machine or by making lighter cuts. With the temperature compensator, which is integral with the correcting device, the pitch of the threads can be increased or decreased up to 0.0001 of the length ground, within limits of plus or minus 0.23 per cent. Also, by manipulation of the change-gears, the effective pitch of the master lead-screw can be changed in small increments.

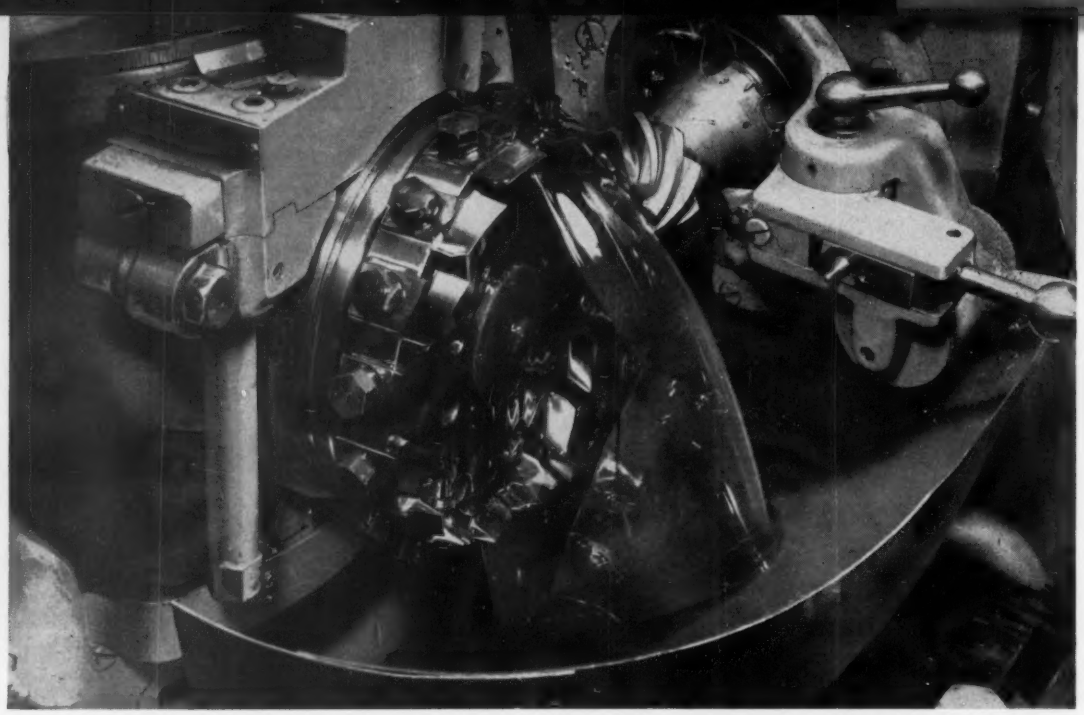
Good results have been obtained by using an active sulphurized and chlorinated mineral oil cutting fluid for thread grinding. This oil, called Sultran 15C and made by Socony Mobil Oil Co., has other additives to increase the anti-welding action and improve the extreme pressure properties. Because of the large number of passes made in grinding the threads to depth, with the resultant light cuts, it has been found unnecessary to provide refrigeration equipment to cool the oil. Before making the final finishing passes, the machine is operated for at least three hours to insure that the oil and machine components have been heated to proper temperature.

Mist produced by the cutting oil during grinding is removed through a flexible duct by the multi-blade fan of a Dustkop vapor collector. The vapor is drawn through a spun-glass filter, and condensate collects in a ring and is piped to a reservoir for re-use in the grinding machine. In this way, approximately 20 quarts of oil are reclaimed per day from two machines. The filter element requires changing only every six months.

Final inspection of another precision lead-screw is illustrated in Fig. 4. Here, measurements over wires are being made on a Pratt & Whitney measuring machine. Direct readings can be made to 0.00001 inch, and pressure exerted on the work is automatically controlled by an Electrolimit tailstock. The lead-screw shown being inspected has an over-all length of 15 inches, with a thread 10 1/2 inches long. Pitch of the thread is 1 millimeter, and the pitch diameter is 0.7500 inch. Periodic error cannot exceed plus or minus 0.0004 inch, and uniformly progressive error is held within plus or minus 0.0003 inch per inch at a temperature of 68 degrees F.

The Precision Thread & Gear Corporation has found through experience that such tolerances can be maintained by carefully controlled heat-treatment and precision thread grinding, without the need for subsequent lapping. However, some customers do attempt to attain the ultimate of a maximum lead error of 0.00002 inch per inch, and no periodic error in the entire length of the lead-screw, by lapping the screw with the nut to be used in the finished machine.

For example, C. Ridell, manufacturer of measuring instruments and comparators for starfields and spectrums in Williams Bay, Wis., follows this procedure. He places the finish-ground lead-screw in the measuring machine in which it is to be used, takes readings at short intervals along its length, and plots a graph showing periodic and progressive errors. Then, the lead-screw is lapped with its mating nut to reduce as much of the error as possible. Finally, readings are again taken on the machine, and a correcting bar is added to compensate for known errors. Other manufacturers lap the ground lead-screws first with three separate nuts, and then with the nut to be used in the machine.



Know Your Cutting Fluids

Proper choice and care of cutting fluids can be as vital to metal-working operations as the precision and performance of the machine tools themselves. This article explains the action of cutting fluids and examines the complex role assigned to these petroleum products. First of two articles

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METAL cutting has long been an art, but now—through the combined efforts of the physicist, the chemist, the metallurgist, and the engineer—it is being transformed into a science. Great strides have already been made in establishing some of the basic principles that govern the cutting and machining of metals. Fundamental information is being accumulated at such rapid rate that it appears all pertinent variables will soon be identified and their interrelationships established.

One major factor in the progress of metal cutting has been the availability of high-quality cutting fluids. Used properly, a suitable fluid offers substantial improvements in tool life and surface finish. Most of these fluids are derived from petroleum and represent years of continuous research and development. With current demands on the metal-cutting industry greater than ever, the petroleum companies are being called on to furnish cutting fluids in increasing quantities and of still higher quality.

Everyone concerned with the machining of metals understands the importance cutting fluids bear on the success of most operations. When properly selected, handled, and applied, they can be of tremendous benefit. However, they are not miracle fluids, and no claim is made that the answer to every machining problem lies in the cutting fluid medium.

Two actions take place in all machining: (1) Formation of the chip from the work-piece by the tool; and (2) Movement of the chip along the face of the tool. Thus, the total work performed by the tool is essentially the sum of the work required to form the chip and the work required to overcome the friction at the tool face. Usually, a factor affecting one action will affect

the other in the same manner. For instance, any steps taken to decrease the friction between the chip and the tool also will decrease the amount of work required to form the chip.

Most of the work performed in cutting is translated into heat. This heat develops with the forming of the chip, and is added to as the chip moves along the tool face. The extent of both the heat of formation and heat of friction is determined by the operating variables and the nature of the tool and work material. If, for example, the metal is brittle, the chip will usually break and crumble, resulting in but little frictional heat.

On the other hand, with a long, curled chip, as obtained with some alloys and mild steels, the pressure with which the chip is forced against the tool face may be extreme, producing high frictional heat. The two views of the turning operation, Fig. 1, show the effect of applying a fluid. Cut dry (left-hand view), the chip is a short, loose curl. When a fluid is applied (right-hand view), the chip is a long, tight curl.

Also, the amount of heat developed in machining hard or tough steels will be greater than that produced in machining low-carbon steels or brass. In any event, heat can be extremely detrimental both to the tool and to the machined surface. Exact correlations between temperature, tool life, and cutting forces are far from being firmly established. However, there does seem to be a direct relationship between the temperature at the chip-tool interface and the life of the tool. As the temperature increases, the ability of the tool to withstand the forces exerted upon it decreases rapidly.

It has been demonstrated rather conclusively that a very small change in temperature can have a pronounced effect on tool life. In the interest of long tool life, the temperature at the chip-tool interface should be kept as low as possible. Also, it is frequently imperative, particularly in grinding operations, that the work-piece be kept cool to prevent inaccuracies in dimensions and changes in surface hardness. Thus, any practical means of removing the heat quickly and reducing the heat developed is extremely desirable.

Cutting fluids can be effective in both respects. Essentially, they serve two functions: (1) As a coolant—to cool the tool to reduce abrasive wear and loss of hardness, and cool the work to prevent distortion and dimensional inaccuracies. (2) As a lubricant—to lubricate the chip-tool interface to reduce frictional heat, tool wear, and power consumption and improve surface finish; also to prevent welding of metal to tool point and subsequent poor finish from the sloughing away of the metal built up on the tool.

In addition, there are a number of secondary, but important, functions of cutting fluids. For example, they serve to flush chips away from the work area and protect finished work surfaces, tools, and machines from rust and discolorization.

The fluids can be divided into two broad groups—cutting oils and soluble-oil emulsions. Cutting oils are most effective as lubricants, reducing the amount of heat formed. Soluble-oil emulsions act primarily as coolants, removing heat that has developed.

Cutting Oils

The lubrication problem created by movement of the chip over the tool face is basically the same as when any surface moves over another at high speed and under high pressure. The type of lubricant most suited to reduce friction and heat is dictated by the type of metals in contact

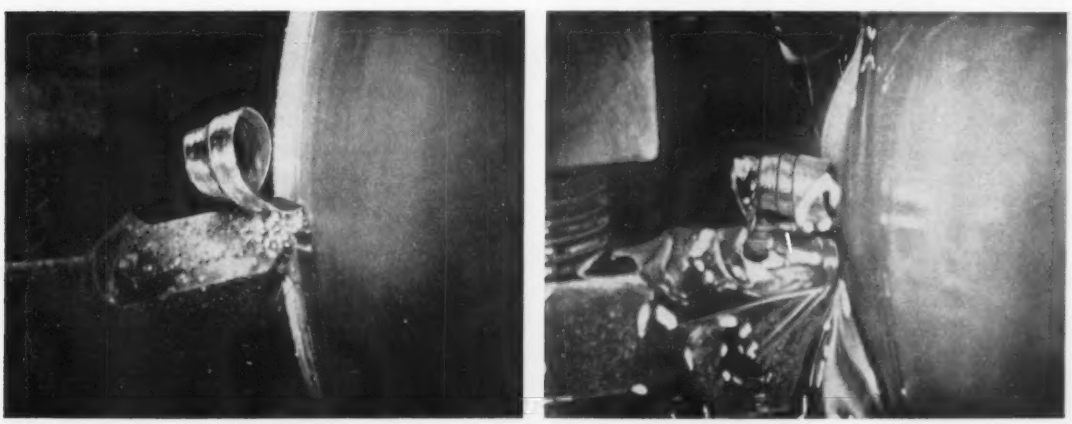


Fig. 1. When cutting oil is applied, the chip changes its form from a short, loose curl (left) to a long, tight curl (right).

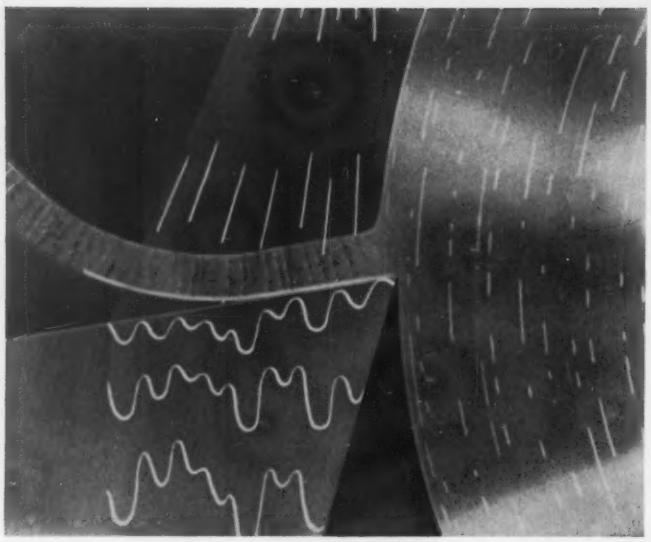
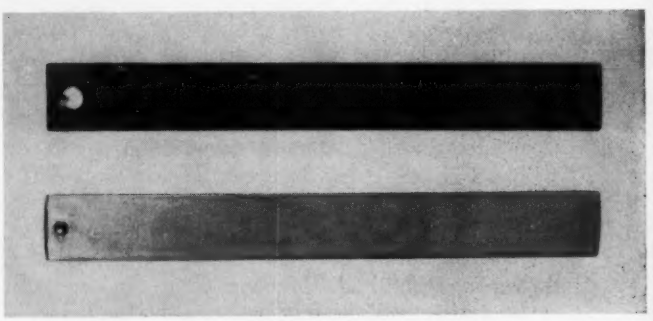


Fig. 2. (Left) Extreme-pressure additives in the cutting oil produce a metallic compound between the chip and tool face.

Fig. 3. (Below) Copper strips from corrosion test performed at 212 degrees F. (Top) After immersion in oil containing active sulphur; (bottom) after immersion in solution with inactive sulphur.



and the conditions under which one surface moves over the other. Cutting and grinding operations are extensive in nature, with many variables of tool, work-piece, and machine to be considered. As a result, lubrication requirements range from very mild to most severe, and several types of cutting oils are needed to meet all requirements. In some instances, a straight mineral oil is satisfactory; in others, mildly compounded oils are needed; and for the most severe requirements, very highly compounded products must be used.

Common ingredients employed singly or in combination in compounding cutting oils include fatty oils, sulphur, sulphurized fatty oils, sulphurized additives, chlorinated additives, and sulphur-chlorinated additives. The effectiveness of compounded cutting oils stems mainly from their chemical activity.

Since the surface of the chip in contact with the tool face is freshly formed, it is in a highly reactive state. This condition, with the high temperature and pressure existing at the point of contact between the chip and the tool, is very favorable for a chemical reaction. The additives in the cutting oil will react with the chip to create a metallic compound. The compound forms as a thin layer between the chip and tool, preventing them from being in physical contact, as can be seen in Fig. 2.

If the shear strength of the metallic compound is less than that of the metal itself, there will be a reduction in friction, with a resulting decrease in the total amount of work and heat. For example, chlorine and sulphur can react to form metal chlorides or sulphides. Fatty oils, on the other hand, can form metallic soaps which reduce friction.

The fatty oils, such as lard oil, by virtue of their polar groups, also give the cutting fluid the ability to spread and penetrate—a property commonly referred to as "wettability," or "oiliness." A cutting oil containing such materials forms a film which adheres to the tool and is stronger and less subject to rupture than a film of straight mineral oil. These characteristics permit fluids containing fatty oils to penetrate between the tool and the newly generated surface. The tough oil film formed there protects the surface from being marred by bits of abrasive materials which may be present.

Sulphur in cutting oils is either active or inactive. These terms merely refer to the effect of the sulphur on a copper strip at a specified temperature. The standard test procedure is to contact a copper strip with the oil at 212 degrees F. If the strip is not discolored, or is only slightly tarnished, the sulphur is termed inactive. On the other hand, if the strip is badly discolored, the oil is said to contain active sulphur. Strips taken from two such tests appear in Fig. 3. The top strip signifies the presence of active sulphur; and the bottom strip, inactive sulphur.

Since the temperature at which this determination is made is far below those encountered in machining, the fact that a copper strip is not discolored does not necessarily mean that the sulphur will be inactive or ineffective at the tool point. Normally, cutting fluids containing active sulphur should not be employed in machining copper alloys or similar materials, since staining might occur. For such applications, products containing inactive sulphur are generally recommended. Cutting oils containing inactive sulphur can also be employed to advantage on many other work materials.

Properties of cutting oils have been improved appreciably through the years. Progress made in transparent, compounded oils has been particularly noteworthy. Transparency in a cutting oil offers certain advantages. With a transparent type product, the operator can readily observe the cutting tool and work-piece through the fluid. Inspection of parts is accomplished quickly and easily. For example, when such an oil is used in generating a gear, Fig. 4, the cutter is clearly visible. In addition, clear oils promote cleaner conditions in the shop or plant—a definite morale builder for the personnel.

Until recently, it was not possible to incorporate a high degree of compounding in a cutting oil and still retain its transparency. Available additives needed to impart extreme-pressure characteristics would darken the oil and, when used in the quantities required, turn it black. Consequently, transparent oils had relatively low extreme-pressure properties and limited application. However, considerable research has been done both in the additives themselves and in the methods used to incorporate them in the oil. Results have been extremely fruitful and now it is possible to prepare transparent oils with sufficient compounding to handle most machining operations satisfactorily. Today, transparent cutting oils are replacing black oils which on many operations were considered indispensable only a short time ago.

Cutting oils currently in use can be classified by various means in accordance with their compositions. From a practical standpoint, oils containing additives will fall into one of three main categories—transparent, active sulphur oils; transparent, non-corrosive oils; or dark, sulphurized oils.

Transparent, Active Sulphur Oils

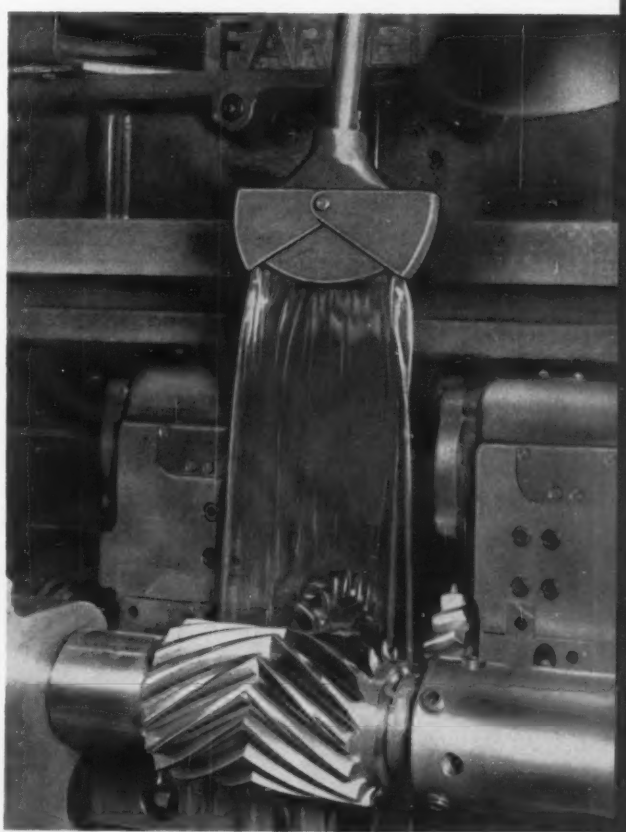
These contain active sulphur, in addition to one or more other materials, including fatty oils, sulphurized fatty oils, and sulphur and chlorine additives. They now may comprise a wide range of compounding and extreme-pressure characteristics and serve satisfactorily on all but the most difficult machining operations. Because of their active sulphur content, these oils may stain copper and copper alloys, and, if used to machine these materials, a subsequent cleaning operation usually will be required.

Transparent, Non-Corrosive Oils

These oils have no active sulphur. They may contain various combinations of fatty oils, sulphurized fatty oils, and sulphur and chlorine additives. Although not as highly compounded as the transparent, active sulphur products and therefore not entirely adequate for some of the tougher operations, they are very satisfactory general-purpose oils for both steel and non-ferrous work material.

Some oils in this group may, in addition to serving as the cutting fluid, be used in the integral lubrication or hydraulic systems of a machine tool. Such oils have a combination of properties and are called "dual" or "tri-purpose" oils.

Fig. 4. The transparency of the oil permits the cutting action to be observed. Operation consists of generating a herringbone gear.



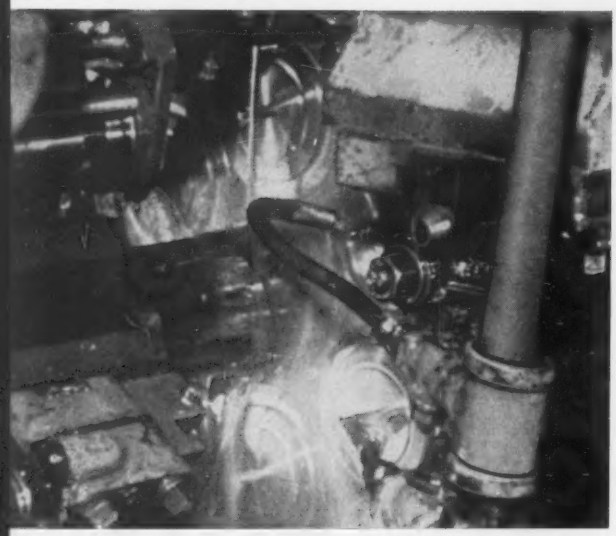


Fig. 5. Transparent, non-corrosive cutting fluid performs a dual purpose on this automatic screw machine—as a cutting fluid and as a lubricant.

However, they should not be regarded as either a cutting oil that may be used as a lubricant or as a lubricant that may be used as a cutting oil. This would infer that the oil was designed for one purpose, but could be substituted for other uses as well.

Over the years, these oils have proved their value, particularly in automatic screw machines. A typical application is illustrated in Fig. 5. In these machines, there often exists a condition wherein, due to leakage, the cutting fluid is mixed with the lubricant and possibly even with the hydraulic fluid. This dilution reduces the over-all compounding of the cutting fluid and soon is reflected in the machining operation. By using the same product for all three applications, there will be no change in compounding on dilution, and consistent machining performance will be maintained.

Even when the nature of the work requires an active sulphurized cutting oil, a non-corrosive "dual" or "tri-purpose" oil can be recommended in machines where leakage is a problem. The reason for this is that dilution of the cutting fluid with the non-corrosive product used as either a lubricant or hydraulic fluid is not nearly as harmful as dilution with a mineral lubricating or hydraulic oil. As a result, the cutting fluid can be used for a much longer time, efficiency is increased, and tool life extended.

In using "dual" or "tri-purpose" oils, however, it cannot be stressed too strongly that reclaimed products should always be avoided, because they undoubtedly will contain metal particles.

Dark, Active Sulphur Oils

Although transparent oils are being used more and more extensively, there are still operations where the highly compounded dark, or black, cutting oils are essential to the desired performance. These may contain the same basic ingredients used in the transparent, active sulphur type oils, but since transparency is not a requirement, larger concentrations can be used to give greater extreme-pressure properties. In Fig. 6, this type of oil is used in an internal broaching operation. Here, the need to observe the cutting action of the tool is not essential, so advantage is taken of the extreme-pressure properties of the dark, active sulphur oil.

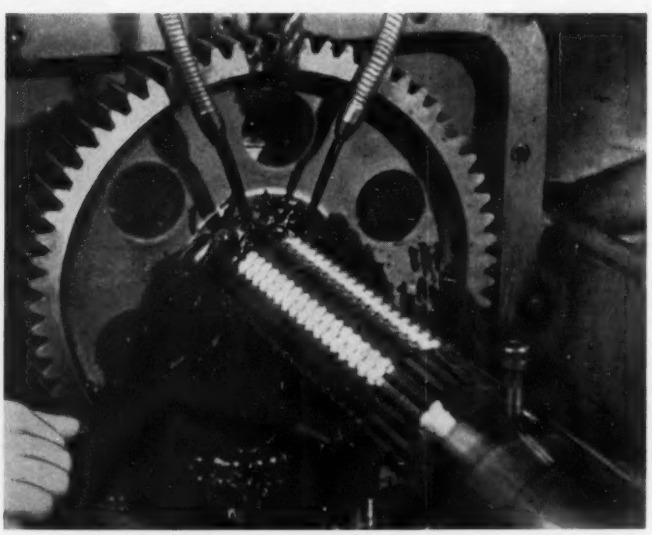


Fig. 6. In this internal broaching operation, visibility is not a factor, and a dark, sulphurized oil is used to advantage.

Cutting Production Costs with Tracer-Turning

As a precision, high-speed production method that can be applied to a wide range of manufacturing operations, tracer-controlled duplication has made great strides since its inception shortly before World War II. Although the fundamentals of this system of turning have been known for years, it is only recently that lathes designed for tracer-turning have come into widespread production-line usage

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EVER since World War II, and particularly since the outbreak of the police action in Korea, certain tooling problems, incident to jet-engine manufacture, were solved only because of the availability of tracer-controlled machine tools. Production engineers and management personnel alike have focussed their attention on this machining method. The tracer technique has made possible new and simpler methods of performing such operations as turning, boring, or facing contours as well as turning multiple-diameter shafts.

Industry's first intensive effort to achieve the mass output of duplicate parts economically dates back to the early twenties, when turning a form on a lathe was an improvised procedure. Although machining templates were frequently devised to serve as guides, the operator still had the problem of manipulating the longitudinal and transverse feeds of his lathe to generate the required contours. Since much depended on the skill of the operator, savings as we know them today were not realized.

In the early thirties the Monarch Keller form-turning machine—a tracer-controlled lathe for turning, boring, and facing of irregular-contour work—emerged. The Keller tracer control is a simple device. Accurate tool guidance results from contact between the stylus and a thin sheet-metal template that has been cut to the exact profile of the work-piece.

Longitudinal and cross-feed movements are secured from magnetic clutches that drive both the lathe carriage and the cross-slide. These clutches, of pancake design, are mounted in a quick-change gear-box and are driven by a variable-speed motor. They operate at the direction of the tracing head which has universal action by means of a ball and socket joint.

Electric circuits to the clutches are opened and closed by the deflection of the stylus from a neutral point, thereby providing the required direction of tool movement. Because the magnetic clutches can be energized or de-energized in 1/125 of a second, the cutting tool responds almost instantaneously to any change in template contour. Flexibility of the automatic profiling control provided by the electric tracer and the magnetic-clutch drive of the unit is indicated by the fact that they operate with equal efficiency on either small-lot or large-run work.

In addition to this electro-mechanical system of contour-turning with a single-point tool, hydraulic methods are currently being used to a great extent. Inherent lack of backlash and low circuit time-lags of hydraulic mechanisms make

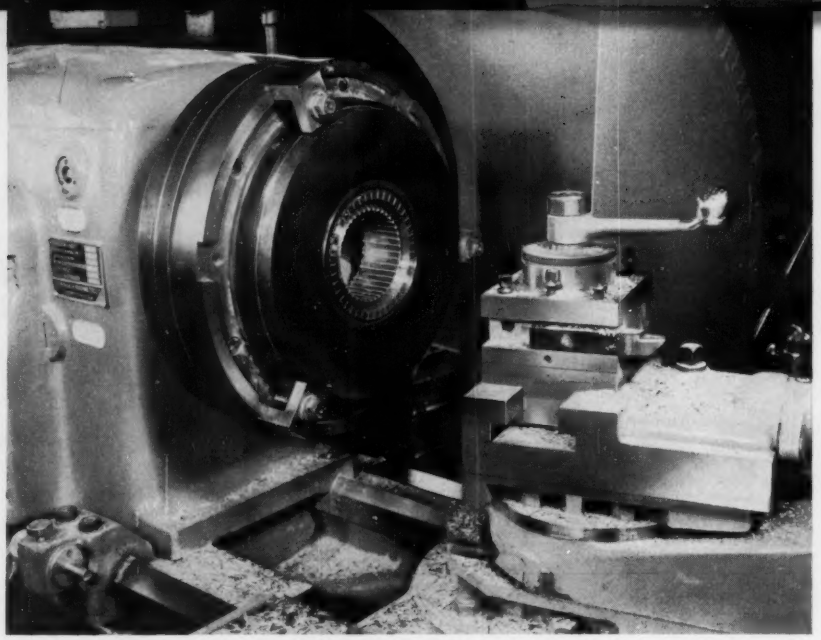


Fig. 1. Cutting V-shaped grooves in the faces of a forty-one-bar commutator assembly on a lathe having a swiveling, tracer-controlled slide.

them particularly advantageous as elements of servo-control systems. One of the newer systems employs an Air-Gage Tracer principle of tracer control. Because of the ability of this system to duplicate a template profile with repetitive accuracy while maintaining control at high feed rates, it is well suited for machining parts that have a continuously changing profile.

On a conventional lathe, the profiling path of the tool in relation to the spindle axis is a result of the individual motions of the carriage and the cross-slide. If the direction of these movements is fixed at an angle of 90 degrees by machine construction, a contour path can be developed by controlling only the slide movement with a tracing system that receives its signals from a template.

This method is used for some classes of work. However, due to the limitations on the magnitude of the tool-slide feed rate, a square shoulder cannot be produced. Furthermore, shoulders approaching an angle of 90 degrees to the work axis require low carriage feed rates to permit the slide to back out.

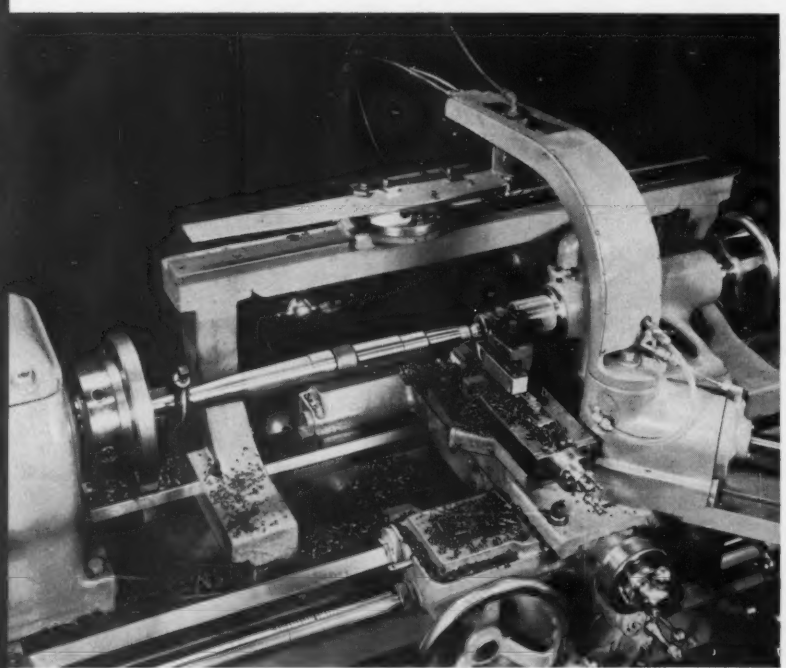


Fig. 2. Tracer-turning of square shoulders is made possible by the angular tool-slide shown extending to right. By backing the tool away from the headstock, the feed motion of the carriage is nullified, and a shoulder is produced at an angle of 90 degrees to the work.

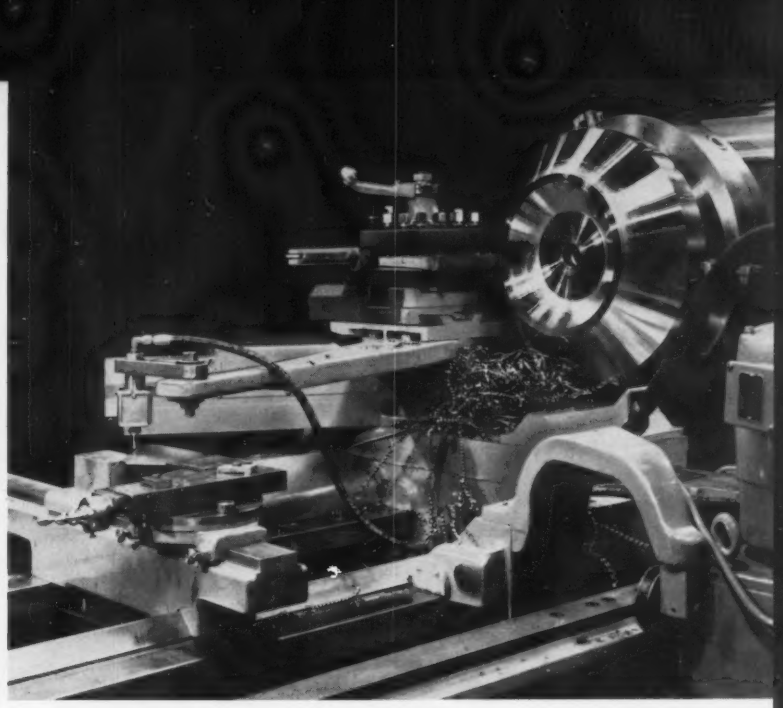


Fig. 3. Contour-turning and contour-boring a part for a cream separator bowl on a tracer-equipped, heavy-duty lathe. The work-piece is a stainless-steel forging.

Obstacles such as these can be surmounted by changing the angular relationship of the basic motions. Square shoulders and steep tapers can be turned by using a single hydraulic servomotor, set at an acute angle to the work-piece axis and controlled by the template. When the carriage advances under power feed and the tracer contacts a right-angle shoulder on the template, the angular slide retracts. As a result, both an outward velocity component and a rightward velocity component are established to cancel the longitudinal feed motion. The slide structure on a lathe of this type can be seen in Fig. 2.

This method is most advantageously applied for turning step-shafts. The tool-slide is then shifted from its customary position, at a right angle to the work-piece, so that it can move at an acute angle to the machine centers. When the stylus contacts a point on the template representing a square shoulder, the tool-slide moves back. This retraction, when combined with the carriage movement, results in a tool travel that is perpendicular to the machine axis.

On some tracer-equipped lathes, the contouring slide, or tool-slide, is controlled by an air-gage type duplicating device. It is a proportional-control type tracing unit employing an air-gaging circuit to actuate a four-way hydraulic valve in the controller unit. Air at a constant pressure of 60 to 65 pounds per square inch—regular plant compressed air being satisfactory—is used. After being filtered to remove foreign particles, the air is passed through pressure regulators where it is reduced in steps to a circuit-operating pressure of 40 pounds per square inch to provide a constant-pressure supply to a fixed orifice.

Below the orifice, the air flow in the circuit is controlled by a stylus-operated, balanced, spool type valve in the tracing head. Deflection of the

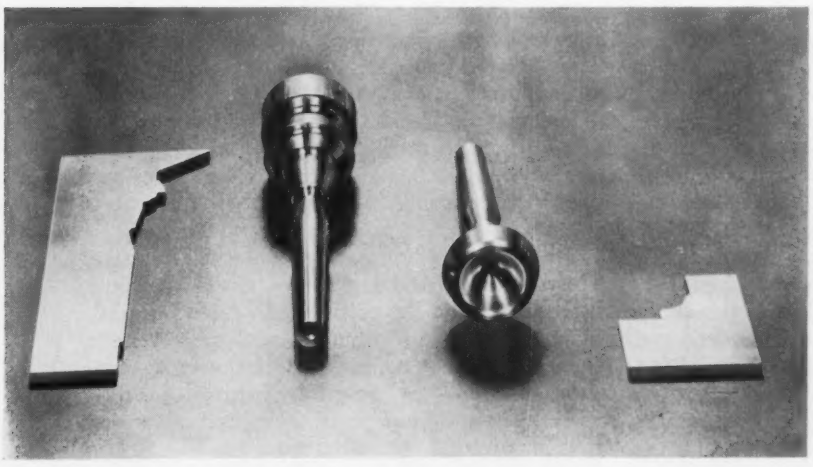


Fig. 4. Trumpet mouthpieces are tracer-turned from brass bars in two set-ups. The two templates are placed alongside the respective work-pieces to show the cuts controlled by each.

Fig. 5. Machining a forged steel printing press roll on a lathe equipped for tracer-turning and automatic cycling. Spacing between the bearing shoulders is held to a tolerance of plus 0.001 minus 0.000 inch.

stylus to increase or decrease the air flow produces corresponding variations in the pressure drop across a fixed resistance. These fluctuations in pressure act on a spring-loaded diaphragm and position the four-way hydraulic valve of the controller unit, thereby determining the direction and speed of the tool-slide. A hydraulic power unit supplies oil under constant pressure to the controller unit.

The versatility of tracer-controlled turning can be applied to four broad classes of work: contour-facing, step-shaft turning, contour-boring, and contour-turning. In one plant, V-shaped grooves were previously machined in both ends of a forty-one-bar commutator assembly on a turret lathe set up with form tools. The job has since been simplified by turning it on an engine lathe having a swiveling type tracing unit. This type of tracing unit permits the use of the angular-slide principle on a wide variety of turning jobs. As can be seen in Fig. 1, the slide is swiveled to bisect the angle of the groove to be turned, thereby allowing both sides of the groove to be tracer-turned with equal facility.

Typical of the speed and accuracy obtainable in step-shaft turning is a job in another plant that consisted of rough- and finish-turning a 23 1/8-inch long shaft of stress-proof steel on a manually operated lathe. When turned on a machine having a tracing unit, as shown in Fig. 2, the shafts were completed in eight minutes per piece and were held to a tolerance of plus or minus 0.001 inch. Maximum depth of cut was 1/4 inch.

Substantial economies in time and equipment for contour-boring and contour-turning of parts for cream separator bowls are being gained by a manufacturer using a tracer-equipped heavy-duty lathe to machine rough-turned stainless-steel forgings, Fig. 3. Three operations are performed, with the same two-section template, having profiles for each surface, being used for all cuts. In the first operation the peripheries of the body and hub are turned, and the body is faced to a reverse taper. After changing the position of the template to present a new profile, the rim is faced and a reverse taper is turned. Finally, the work-piece is reversed to present the side illustrated, and the position of the template is altered to permit the corresponding profile to be used. Then the inside taper is rough-turned, and the part is completely finish-turned and bored. The total time required for these operations is twenty-five minutes.

The ability of a tracing unit to turn and bore a multiplicity of forms on the same work-piece is demonstrated in machining the trumpet mouthpiece illustrated in Fig. 4. Made from 1 1/4-inch diameter brass bar stock, it is completely rough-turned, finish-turned, and bored to a tolerance of plus or minus 0.001 inch in three minutes and twenty-five seconds. Maximum depth of cut is 1/4 inch.

Tracing units impose no limitations on size. The rate of feed and depth of cut are limited only by the forces on the cutting tool. Added flexibility and speed can be obtained with an automatic cycling unit that converts the lathe to a semi-automatic machine. One job that was handled with this type of equipment consisted of turning rolls for printing presses, as shown in Fig. 5. Ma-

chined from SAE 1045 steel forgings, the rolls require a tolerance of plus 0.001 minus 0.000 inch on the spacing of the bearing shoulders. The job was finished in a turning time of only one and one-half hours.

Either round or flat templates can be used as guides for tracer-turning. Round templates are often preferable for small-lot, infrequently repeated runs. They can be turned manually on a lathe, then placed between centers on the template rail to guide the cutting tool for the production of identical parts. On the other hand, because flat templates require relatively little storage space, they prove especially efficient for frequently repeated runs. Hardening of the templates is unnecessary as the stylus pressure is only 5 to 6 ounces.

Maintaining constant surface speed is important. When there are at least two diameters on a work-piece, it must be rotated at a surface speed that is low enough to prevent tool burning on the larger diameter. It is possible that the surface speed of the smaller diameter will be below optimum. Constant surface-speed equipment is available that provides the proper work speed for any surface being turned.

Replacement Potential Studied by Machine Tool Distributors

CREATIVE selling and the exploration of methods by which the distributor can accelerate replacement purchases were the focal points of the thirty-second spring meeting of the American Machine Tool Distributors Association. The meeting was held recently at the Hotel Statler, Detroit, Mich.

In opening the meeting, Henry R. Hanson, president of the A.M.T.D.A. and vice-president of the William K. Stamets Co., Cleveland, Ohio, pointed out that while the Machine Tool Show of last year resulted in increased orders, the industry is not disposed to accept this general improvement as the full benefit of the show. He said, "Today, the pressures to reduce costs and increase productivity are creating a climate for capital expenditures. Modern machine tools offer these incentives."

In his talk, "What's Ahead in Machine Tools," Ray H. Sullivan, vice-president of the Ford Motor Co., Detroit, Mich., told a luncheon meeting that in his opinion the machine tool industry and industry in general are headed for a "tremendous ten years." He went on to say that there is evidence that 1956 will set an all-time record of about 32 billion dollars in business spending for new plants and equipment. Mr. Sullivan also said, "Today's machine tools, properly equipped with automation, have enabled us to provide safer and healthier working conditions for our employes, and at the same time have much improved our economy."

Postwar improvements in machine tools have opened the way for American industry to achieve production output beyond anything imagined, Louis Polk, president of the National Machine Tool Builders' Association and the Sheffield Corporation, Dayton, Ohio, told the meeting in his talk, "Productivity and Progress." Pointing to the problems created for American industry in recent years by increased taxes and operating costs, Mr. Polk said, "There is one principal compensation on which industry has relied in order to survive during this period. It is the compensation of increased productivity."

Noting that the capacity for greater production is provided by machine tools, he continued, "It is a tribute to our own industry that it has been able, with ever-continuing research, to keep pace with the needs of American industry for perpetual progress." The speaker added that "there is considerably more that can be done by all of us to convince the industrial community that the production advances we offer are real, tangible, and necessary—not only to meet competition, but in order to continue to meet all of the nation's and our own economic obligations."

James C. Kelley, general manager of the A.M.T.D.A., told the group that the replacement of outworn machine tools represents one of the greatest challenges to the machine tool industry. He cited a survey, made by the American Society of Tool Engineers, which shows that 16 per cent of all manufacturing operations in the metalworking industry can be automated. This would mean replacing more than 255,000 machine tools including grinding and finishing machines.

A panel discussion, "Selling the Replacement Market," was another feature of the meeting. Members of the panel were: D. M. Pattison, vice-president of the Motch & Merryweather Machinery Co., Cleveland, Ohio; J. A. Raterman, president of the Monarch Machine Tool Co., Sidney, Ohio; and C. A. Woodley, vice-president, manufacturing, at the Caterpillar Tractor Co., Peoria, Ill.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Medium-Carbon-Alloy Die Steel for Molds and Cavities

A medium-carbon-alloy die steel called "MC-Mold and Cavity Steel," designed to provide a steel for molds and cavities where high surface finishes are desired, has been developed by the Vanadium-Alloys Steel Co., Latrobe, Pa. The product can be uniformly hardened at hardness ranges of from 300 to 350 Brinell throughout sections as large as 20 inches by 10 inches. High surface hardness is obtained by carburizing and then oil quenching.

This steel is available either annealed or heat-treated to a hardness of 300 Brinell—still readily machinable. The new grade takes a fine finish with little danger of troublesome pits caused by metallic inclusions. Particularly suitable for molding clear plastics, it is available in large rounds or blocks.

High-Nickel Brazing Alloys for High-Temperature Service

A series of high-nickel brazing alloys with the same mechanical properties and corrosion and oxidation resistance as the stainless and heat-resistant alloys—which they are mainly designed to join—has been developed by Coast Metals, Inc., of Little Ferry, N. J. There are four distinct alloys for brazing and hard-surfacing applications which are known as the "Coast Metals 50" series. The alloys are produced in rod, powder, strip, and washer form and can be used to successfully braze most metals having melting temperatures above 1850 degrees F.

All alloys have the following nominal chemical composition: nickel, 72.50 to 93.25 per cent; silicon, 3.50 to 5.00 per cent; and boron, 1.90 to 3.50 per cent. However, in addition, one of the alloys contains chromium in the amount of 7.00 per cent and iron in the amount of 3.00 per cent, and another contains chromium in the amount of 16.00 per cent and iron in the amount of 4.00 per cent. Their flow points (in dry hydrogen) range from 1825 degrees F. to 1930 degrees F. All alloys have good flow and wetting qualities.

The alloys have been used to braze rocket nozzles to their respective components and were actually found to be stronger than the parent metal. Other applications of the new nickel alloys include the coating or brazing of roller parts, honeycomb materials, jet-engine components, and valves requiring corrosion resistance.

Soluble Emulsifiable Oil Type Cleaner with Anti-Rust Properties

A soluble, emulsifiable oil type cleaner containing additives for the removal of organic soils such as cutting fluids, shop soils, drawing compounds, and greases has been announced by the Haviland Products Co., 421 Ann St., N.W., Grand Rapids, Mich. "Anti-Rust Cleaner CP," as this material is called, also imparts anti-rust properties while cleaning. The material forms a stable emulsion with hot or cold water, over a wide range of dilutions and with any water hardness condition.

The cleaner can be diluted in the ratio of 1 part to 30 to 50 parts of water by volume, for use as a power-wash and an anti-rust spray. When diluted in the ratio of 1 to 30, it can be used as a coolant. It is used as an anti-rust dip at full strength, or when diluted in the ratio of 1 part cleaner to 10 to 20 parts of water.

Silver Solder Alloys for Joining Dissimilar Metals

Two silver solder alloys have been announced by the All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y., to solve some of the problems encountered in the assembly of dissimilar ferrous and non-ferrous metals. These alloys were designed for joining aluminum, copper, brass, bronze, stainless steel, steel, Monel, and combinations of these and other metals. Both of these new products may be used with any heating method that is generally applicable to soldering. The melt and flow points are in the medium-temperature range—between soft solders and low-temperature brazing alloys.

The first, designated "All-State No. 105 Medium Temperature Solder," exhibits a shear strength of 18,000 pounds per square inch. It melts at 675 degrees F. and flows freely at 750 degrees F. The other alloy, called "All-State No. 107 General Purpose Silver Solder," has a shear strength of 20,000 pounds per square inch and exhibits good corrosion resistance. This alloy melts at 450 degrees F. and flows freely at 600 degrees F.

Both alloys are recommended for lap, sleeve, and socket type joints. Each requires a special flux and its residue should be washed off with warm water. Alloys are available in wire diameters of 1/16, 3/32, and 1/8 inch.

Laminate in Automatic Production of Electronic Equipment

A plastic laminate with properties particularly suited for automatic production of electronic equipment utilizing printed circuits has been announced by the General Electric Co.'s Chemical & Metallurgical Division, Pittsfield, Mass. Designated "G-E Textolite (R) cold punch 11570," the material is a high insulation-resistance XXXP phenolic, paper-base laminate which permits close registration punching at normal room temperatures.

Dimensional changes are not encountered in this material which might otherwise be due to a combination of heat and punching stresses. This allows for precision punching of printed circuits, facilitating the use of automatic assembly equipment in mounting components. Since the material is translucent, it permits a visual check for accuracy of circuit registration. Other features include high flexural strength, very low power factor, high heat resistance, and high uniformity.

Large Hexagonally Shaped Steel Bars Now Available

In addition to making available various sizes of hexagonally shaped standard grades of steel bars in the 1/4- to 3-inch size range, the La Salle Steel Co., P.O. Box 6800A, Chicago, Ill., has announced the availability of large hexagons—made of C-1018 steel—in the 3- to 4-inch size range. Called "La Salle Large Hexagon," the bars have the following nominal composition: carbon, 0.15 to 0.20 per cent; manganese, 0.60 to 0.90 per cent; phosphorus, 0.04 per cent max.; sulphur, 0.05 per cent max.; and the balance, iron. These hexagons are available in diameters of 3 1/4, 3 1/2, 3 3/4, and 4 inches. They are ideal for the production of large nuts, bolts, and other parts requiring this shape. These bars are also well suited for maintenance applications where replacement parts must be made quickly. Their use reduces machine down and personnel standby times.

Triple-Additive-Treated Water-Soluble Cutting Coolant Developed

A triple-additive-treated, water-soluble cutting coolant called "Hypercut XX" has been announced by Destiny Products Co., 2970 W. Grand Boulevard, Detroit 2, Mich. The first of the three additives used in making this product is a lubricant. This enables the coolant to operate with reduced friction heat in almost any machining operation. The second additive is an anti-foaming agent which eliminates bubbling due to turbulence in the central storage coolant tank or in the machine tool tank. The third additive is a bactericide which is claimed to combat common forms of bacteria and to result in the prevention of dermatitis and in the elimination of odors.

High lubricity facilitates the machining of high-hardness alloys. Machining speeds of 400, 500, and 600 surface feet per minute and higher may be used. Hypercut XX is recommended for drilling, milling, form milling, tapping, sawing, reaming, grinding, and turning. Recommended mixtures range from 1 gallon of coolant to 10 or 20 gallons of water for production sawing, while for grinding 1 gallon of coolant to between 50 and 200 gallons of water is said to produce excellent results.

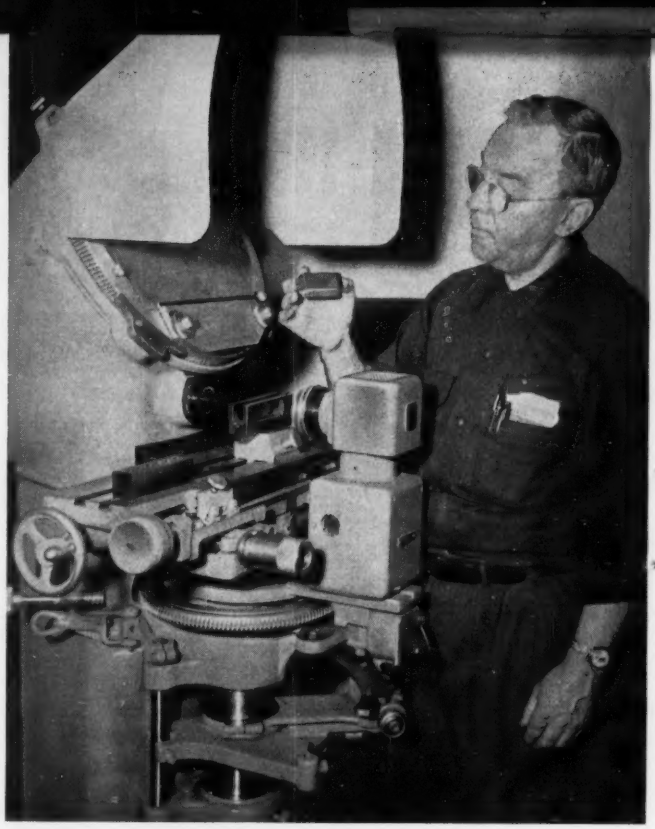
Hard-Facing Material Resists Heat and Fretting Corrosion

A nickel-chromium-boron-tungsten hard-facing material that provides a wearproof, corrosion-resistant surface to parts exposed to extreme conditions of vibration or heat has been made available by the Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich.

Called "Colmonoy No. 70," it was originally developed to overcome fretting and fretting corrosion on jet-engine shafts, at temperatures of 1000 degrees F. and higher. It is also recommended for use on engine valves, chemical valves, acid pump parts, coal washers, and cement screws. This material provides a wear-resistant surface for handling scouring type loose abrasives. It is available as a powder for application by Spray-welding or as welding rod in 3/16-, 1/4-, 5/16-, and 3/8-inch diameters for application with an oxy-acetylene torch flame. Castings of this material are also available.

The surface of the deposited material has a hardness ranging from 50 to 55 Rockwell C. The hard-facing material has a specific gravity of 8.5 and a melting point of 2000 degrees F.

Internal Threads Checked by Optical Comparison



AN interesting system for optically checking the accuracy of internal threads makes use of a cast duplicate. This method of product testing is part of the quality-control program practiced by the National Supply Co., Pittsburgh, Pa.

To measure optically the error on an internally threaded component, it is first necessary to make a small cast of a portion of the thread. This is done by placing a special mold on the section of the thread to be checked. Threads of the same form and pitch as those on the work-piece are cut on the bottom surface of the mold to insure a good fit between the two members.

A molten mixture of graphite and sulphur, known as Plasual Special, is poured into the mold, Fig. 1. This material is received in rock form and is melted over a slow heating burner. At a temperature of about 250 degrees F. it begins to melt, and at a temperature ranging from 300 to 320 degrees F. it reaches satisfactory pouring consistency.

Within five minutes after pouring, the cast will set. It is then removed from the mold and placed on a staging fixture mounted on the bed of a Jones & Lamson optical comparator and measuring machine as shown in Fig. 2. This operation may be seen from a distance in the heading illustration. The full profile of the thread is projected onto a 14-inch diameter screen over which has been clamped a plastic chart engraved with the

Fig. 1. Pouring a molten mixture of graphite and sulphur into a special mold placed on the inner surface of a threaded coupling. The resulting cast will bear the accurate form of the internal thread to be checked.

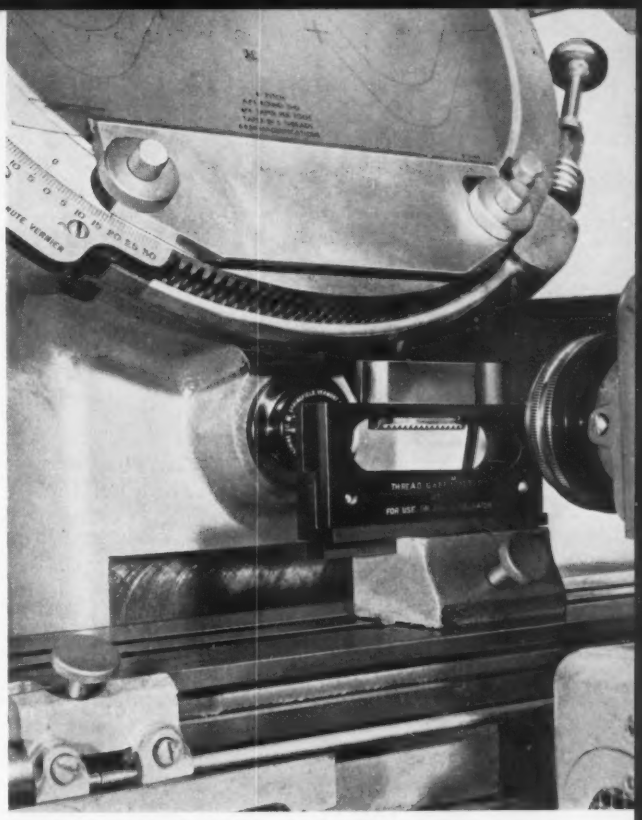


Fig. 2. Cast of the thread to be inspected is mounted on a staging fixture of an optical comparator. The thread formation intercepts the beam of light from the projection head at the right.

desired thread form. Adjustment of the comparator table can be made to bring the helix angle of the thread parallel to the projected light path. The shadow of the cast threads can be maneuvered for comparison with the accurate profile on the plastic chart.

A 1-inch capacity micrometer, graduated in increments of 0.0001 inch, is located on the base that supports the table of this Model PC-14 optical comparator. When making horizontal measurements, the micrometer is first set to a reference graduation; then the projected outline of the threads is adjusted to match the chart outline. Either a measuring bar or a size block, of the same length as the space to be measured, is inserted between the anvils of the micrometer. Error is indicated if the shadow of the second projection does not coincide with the chart outline. The amount of error can be read from the micrometer by moving the table until the chart outline and the shadow are aligned.

Bolt Stresses Not Always Increased by External Loads

Stress conditions, produced by applying an external load to a bolt, vary for different types of joints and do not always add to the stress in the bolt, according to information supplied by Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. For example, in a rigid joint, where two hard surfaces are bolted together and may be considered a solid unit, external loading does not increase the stress in the bolt unless the load is greater than the residual tension.

In a flexible joint, external loading adds to the tightening stress. Bolt stress is thus the sum of the residual tension in the bolt and the external load. A flexible joint is one in which two soft surfaces, one hard and one soft surface, or two hard surfaces separated by a gasket to prevent leakage are bolted together.

When a rigid joint is employed, the torque applied should be as near as possible to the yield strength of the bolt, so that it will resist a maximum amount of external load without loosening. In a flexible joint, the torque used to tighten the bolt should be just enough to prevent leakage. This will leave the remainder of the bolt strength to take care of any external load that should happen to be applied.

Summer Sales Conference to be Held at Purdue

This year's Machine Tool Sales Conference, sponsored jointly by the American Machine Tool Distributors' Association and the National Machine Tool Builders' Association, will be held from July 30 through August 3 at Purdue University, Lafayette, Ind. Already, nearly 300 reservations have been received, and it is anticipated that attendance will be the largest for any single conference of the eleven held since 1948. Assurance has been given that there will be sufficient rooms available for everyone wishing to attend.

Consisting of lectures as well as classroom instructions, the five-day program will make use of the services of a faculty of twenty men, headed by Professor Harry J. Loberg as educational director. Associated with Professor Loberg, who is director of the Sibley School of Mechanical Engineering, Cornell University, will be Professor O. D. Lascoe, professor of Manufacturing Processes, Department of Mechanical Engineering, Purdue University. On the program also are addresses by H. R. Hanson, AMTDA president, and vice-president and sales manager of the William K. Stamets Co.; and Louis Polk, NMTBA president, and board chairman and president of the Sheffield Corporation.

How to Use Carbide Tools in Machining Titanium

By Warren E. Fraser, Metal Cutting Specialist
Aircraft Accessory Turbine Department
General Electric Co.
Lynn, Mass.

MANY articles have been written on titanium, but few have attempted to explain why this material is so difficult to machine. Little has also been written on the modified carbide cutting tools necessary, or the feeds and coolants that should be used to improve the machining of titanium.

One of the basic considerations in determining the machining characteristics of a material is to study the chips formed in cutting. A rough estimate of the machinability of a metal can be obtained by determining the ratio of the length of chip to the distance the cutting tool travels in making the chip. This ratio is directly proportional to the depth of cut D and the chip thickness T and is a function of shear angle ϕ, as indicated in Fig. 1.

As the chip-length ratio increases, the shear angle becomes larger, indicating a more machinable material. For example, wood has a chip-length ratio of 1, steel 0.4, and titanium 0.8, as seen in Fig. 2. The shear angle for titanium is therefore greater than that of steel. Despite this theoretical advantage titanium is more difficult to machine.

This inconsistency is a consequence of the heat generated during cutting, and is the prime cause of tool failure. The larger chip-length ratio causes the chip, as it is formed, to pass over the tool face more rapidly, resulting in most of the cutting force being changed into frictional energy or heat. In addition, the heat-dissipating quality of titanium is poor—approximately half that of steel. Thus the tool cutting face is subjected to considerably more heat than in machining steel.

It has further been determined that the "chip-contact area," the area on the cutting tool face over which the titanium chip is deflected, is about one-third that of steel, as illustrated in Fig. 3. Thus, the large chip-length ratio, the poor heat-dissipating quality, and the small chip-contact area of titanium combine to subject the tool face to an excessive amount of heat as indicated by the chart in Fig. 4. Tool-tip temperatures meas-

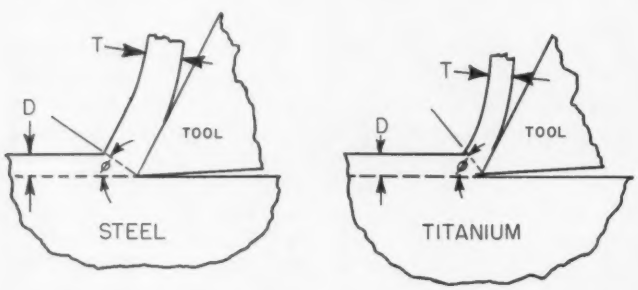


Fig. 1. (Left) In machining titanium the chip-length ratio is greater than in cutting steel, and the shear angle is higher.

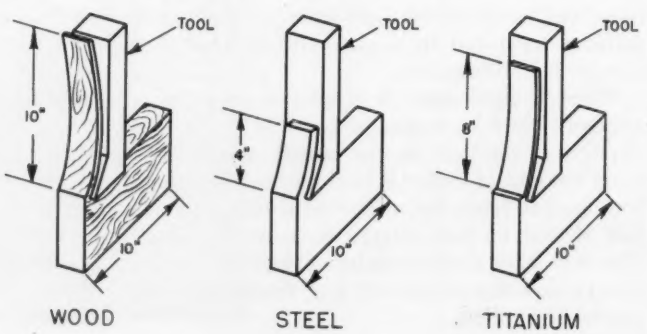


Fig. 2. (Right) A comparison of the chip-length ratios when cutting wood, steel, and titanium.

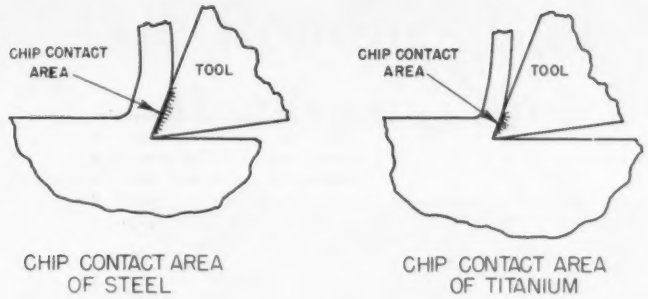


Fig. 3. The small "chip-contact area" of titanium is a contributing factor to tool breakdown.

ured when cutting Rem-Cru C-130 AM titanium (see line 1) are considerably higher than those recorded when 18-8 stainless steel (line 2) or AISI B-113 steel (line 3) are machined.

Titanium, when heated, alloys with most materials. The titanium chip, when deflected on the cutting face of the tool, welds instantaneously to the tool face. As the weld is being broken, portions of the tool face are carried off by the titanium chip. This "galling" changes tool geometry, weakens the cutting edge, and causes rapid tool failure.

To obtain any degree of success in machining titanium, the heat must be reduced or spread over a larger area. The use of slow cutting speeds and heavy feeds with conventionally designed tools will tend to reduce the amount of heat generated, and permit it to be more readily dissipated over a larger chip-contact area.

Other approaches that permit the use of faster cutting speeds with heavy feeds are: to increase the side cutting-edge angle; or to use a large nose radius. This spreads the chip over a longer chip-contact area, which results in less concentrated heat on the tool cutting face.

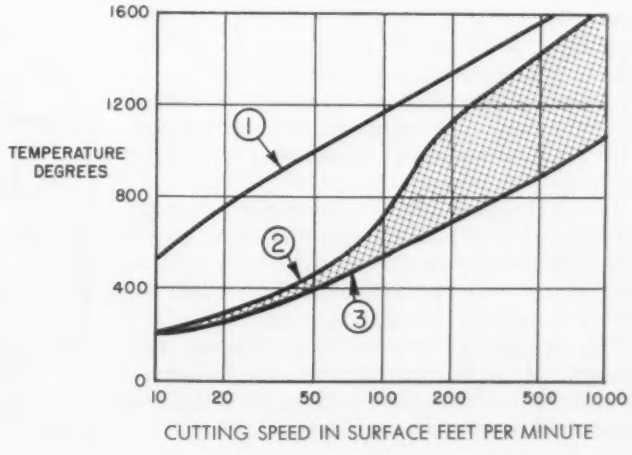
A third approach is to use negative rake tools if the set-up is rigid enough to warrant their use. A chip formed on a negative rake cutting tool has a larger chip-contact area than that formed on a positive rake tool. This results in less heat concentration on the tool face. Tools designed according to these principles are illustrated in Fig. 5.

Relief angles for carbide tools used on titanium should be from 7 to 10 degrees—heavier feeds require the larger relief angle. Grades of tungsten carbide should be the harder, more wear-resistant cast-iron cutting grades, such as Carboloy 883 and Carboloy 999. Steel cutting grades and the softer cast-iron cutting grades are not satisfactory.

Nose radii should either be extremely large (approximately twice the depth of cut) or completely eliminated. Conventional nose radii cause premature tool failure as they tend to create a focal "hot spot" on the tool face, which causes rapid tool erosion in this area. Tool cutting edges should be honed slightly (0.002 to 0.004 inch) at an angle of 45 degrees to break down the feather edge caused in sharpening.

Carbide tool cutting speeds from 100 to 175 surface feet per minute can be used in machining titanium alloys. The hardness of the alloy will greatly influence the speed at which it can be machined. For example, an alloy with a hardness of 36 Rockwell C will require a much slower cutting speed than an alloy with a hardness of 28

Fig. 4. This chart compares the higher tool-tip temperatures when machining titanium (1) and steel (2 and 3) at various cutting speeds.



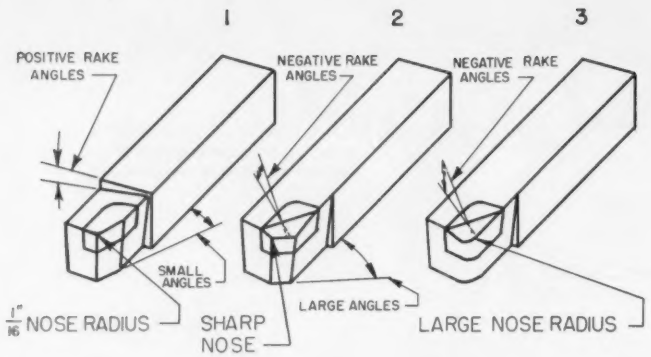


Fig. 5. Typical carbide tool design for machining steel is shown at (1). The use of a large nose radius and negative rake for machining titanium is shown at (2) and (3).

Rockwell C. Every attempt should be made to utilize alloys below 36 Rockwell C, since harder alloys are extremely difficult to machine. Feeds from 0.010 to 0.035 inch can be used. When machining commercially pure titanium, cutting speeds are generally greater—from 125 to 300 surface feet per minute—again depending on hardness. Feeds can be similar to those used with the titanium alloys.

Water-soluble coolants are generally used when machining titanium with carbide tools. The use of cutting oils is not recommended, due to the smoke created when oil contacts the hot cutting tool face. Relatively heavy concentrations of water-soluble coolants work best, such as a 10 to 1 or 20 to 1 mix. Sodium nitrite solutions, which work well when grinding this material, have shown considerable promise on carbide machining operations.

Fixtures used in machining titanium should be as rigid as possible. Flimsy set-ups promote workpiece deflection, causing the tool to rub on the tool relief angles and resulting in galling and premature tool failure.

If scale is encountered, the use of carbide tools is an absolute "must" since other tool materials will fail badly. The depth of cut should be well beneath the scale, and the portion of the cutting edge encountering the scale should be well honed. A typical carbide tool for use in machining titanium having heavy scale is seen in Fig. 6. Very slow cutting speeds, from 25 to 40 surface feet per minute, are necessary, and a tough carbide (such as Carboloy Grade 44A) should be used.

The techniques here outlined are currently used to machine titanium development components in the Aircraft Accessory Turbine Department of the General Electric Co. The experience with this metal to date indicates that its machinability compares favorably with that of 18-8 stainless steel. Cutting speeds are somewhat slower, but feed rates are higher, resulting in a comparable amount of stock removal.

Electric-Melted Steel in America Fifty Years Old

April 5 marked the fiftieth anniversary of the pouring of the first heat of electric-melted steel in America. The original furnace, now enshrined in a park on the grounds of the Sanderson-Halcomb Works, Crucible Steel Co. of America, Syracuse, N. Y., was installed and operated under the personal supervision of its inventor, the French scientist, Paul Louis Toussaint Heroult. Use of the electric arc melting furnace is now recognized as the greatest advance in the manufacture of special-purpose steel since the invention of the crucible process. Today, "electrics" carry on the traditions of fine steel-making, accounting for 8.6 per cent of total domestic steel capacity in 1955. These furnaces have eliminated the laboriousness and high cost of the crucible process.

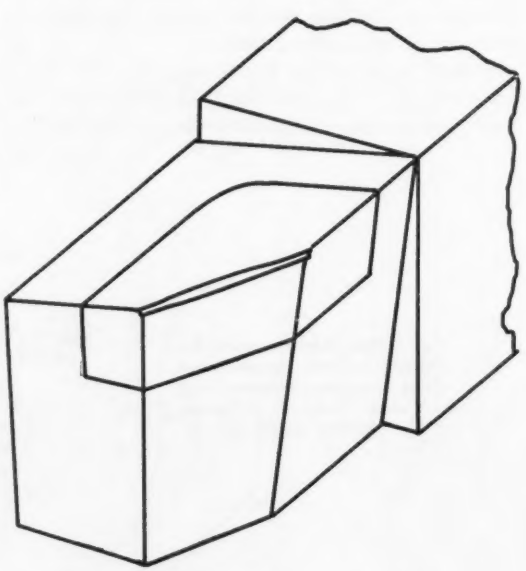
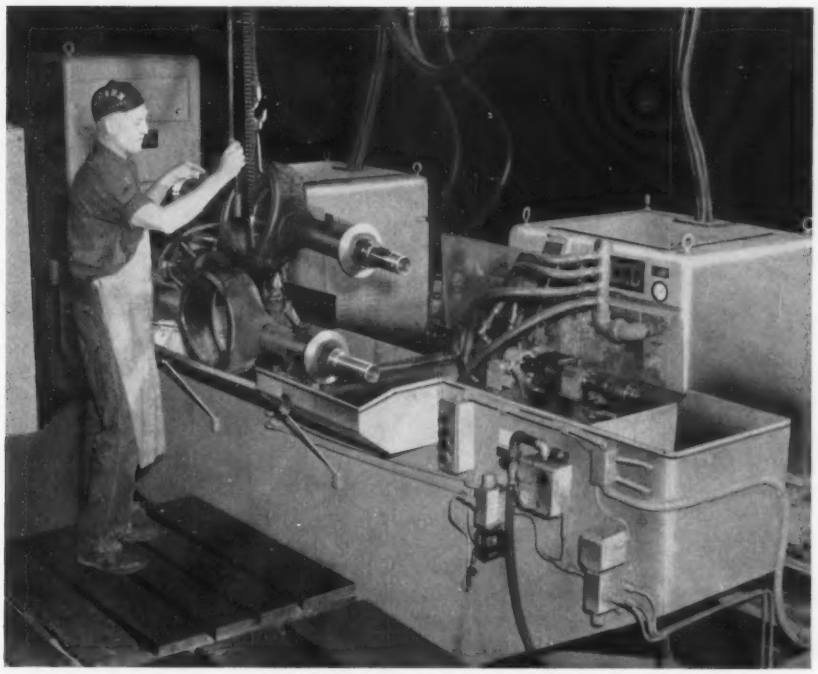


Fig. 6. Diagram of a carbide tool for machining titanium having heavy scale.

Axle Housings Undergo Localized Hardening and Tempering



A complete cycle of localized hardening and tempering is carried out in a single setting while the axle housing rotates slowly inside induction coils. All phases of the cycle are automatically timed

By L. M. GRAY
Chief Engineer, Axle Housings
Clark Equipment Co.
Buchanan, Mich.

TRUCK axle housings, forged from either seamless or welded tubing, are a major product of the Clark Equipment Co. in Buchanan, Mich. The housings are manufactured from a modified SAE 1035 type steel and are heat-treated throughout.

It is the current practice, on certain models, to harden and draw the area of the inner wheel-bearing seat to 65 Scleroscope. Although such localized heat-treating is performed on numerous small parts, it is an uncommon operation on a component the size of a truck axle housing. A Tocco induction heating machine, shown being loaded in the heading illustration, was especially designed to harden, quench, and draw both inner wheel-bearing seats simultaneously in a single set-up.

When the housing has been supported on centers, two induction coils having integral quenching rings are slipped over the machined wheel-bearing sections to be hardened. Each coil is placed so that it surrounds the section of metal to be heated, but does not touch the tubular end of the housing.

As soon as the forging is loaded, a start-button is pressed to initiate the cycle. The axle housing then begins to rotate slowly about its own axis, as shown in Fig. 1. Simultaneously, both induc-

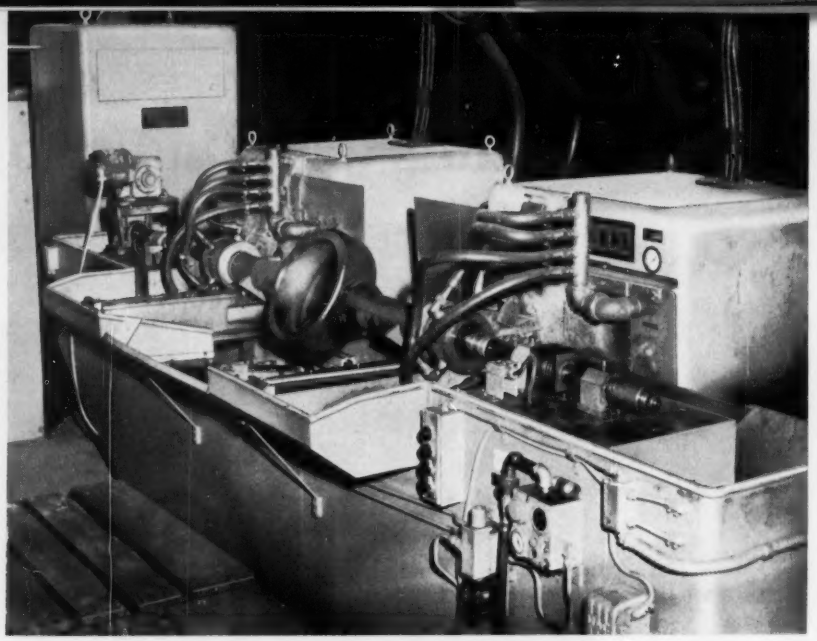


Fig. 1. A forged truck axle housing is rotated between centers on an automatic induction heating machine. A coil at each end of the housing hardens the wheel-bearing seats.

tion coils are energized. Heating starts and is continued for thirty seconds—controlled by a timer. During this brief heating phase, the bearing area is heated to 1550 degrees F. After the current is shut off, water at tap pressure is directed into the quenching rings, Fig. 2; the resulting jets quickly cool and harden the involved sections of metal.

Quenching is halted by the timer which first shuts off the water supply and then re-energizes the two induction coils. The bearing areas are reheated for only nine seconds, at the end of which time they reach the drawing temperature of 600 degrees F. Current is then shut off and water is again applied to cool the ends. This second quenching phase completes the heat-treating cycle and brings the two bearing areas to the specified surface hardness.

After the water is shut off, the axle is removed from the machine. Floor-to-floor time is approximately one and one-half minutes. Since the cycle is automatic, once the start-button is pressed, uniform results are obtained. The services of only one man are required to maintain a steady production flow. A trolley hoist is employed to load and unload the axle housings.

Fig. 2. Both heated ends of an axle housing are quenched simultaneously. This operation is part of an automatic hardening and tempering cycle which brings the bearing areas to a hardness of 65 Scleroscope.

Soldering Combined with Press Operation

TO eliminate a production bottleneck, drain fittings are soldered to gasoline tanks at the same time that a press operation on the tanks is performed at the Buick Motor Division, General Motors Corporation, Flint, Mich. In preceding operations, both halves of the tanks are formed and the rims joined in a continuous seam weld. Then, each tank is brought to a press which flattens the rim at four points for the attaching straps, and the drain fitting is induction-soldered.

Close-up views of the press bed are shown in the accompanying illustrations. After the tank is positioned, a fitting *A*, Fig. 1, coated with flux and provided with a ring of solder, is located manually over a small drain hole pierced in the tank. The press carries a forming tool *B* for each of the four strapping points to be flattened. An induction coil is supported on a rocker arm *C* mounted on the press and in line with the drain hole.

Before the press starts its stroke, the arm moves down, simultaneously clamping the flange and energizing the induction coil. The heat melts the solder, and as soon as it flows into the joint, the coil is de-energized automatically. Meanwhile, the press ram has decended, as in Fig. 2, and the forming tools flatten the rim. On the up stroke, the rocker arm is again elevated.

Fig. 1. (Above) At the start of the press cycle, the rocker arm is elevated over the drain fitting.

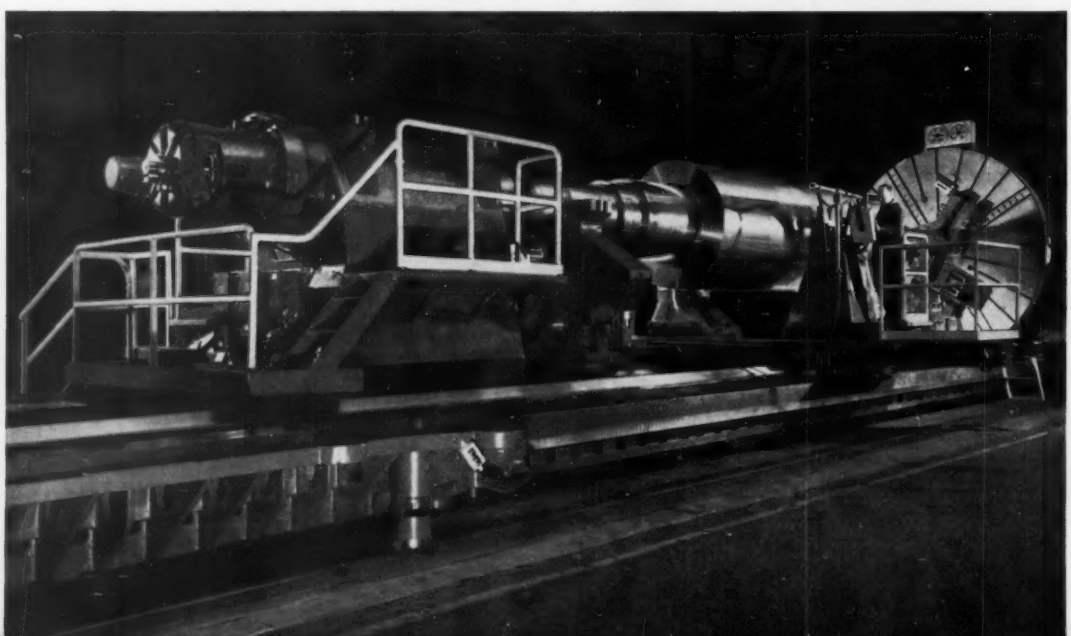
Fig. 2. (Left) Shortly after the coil on the rocker arm is energized, the press executes its down stroke.

In Shops Around the Country

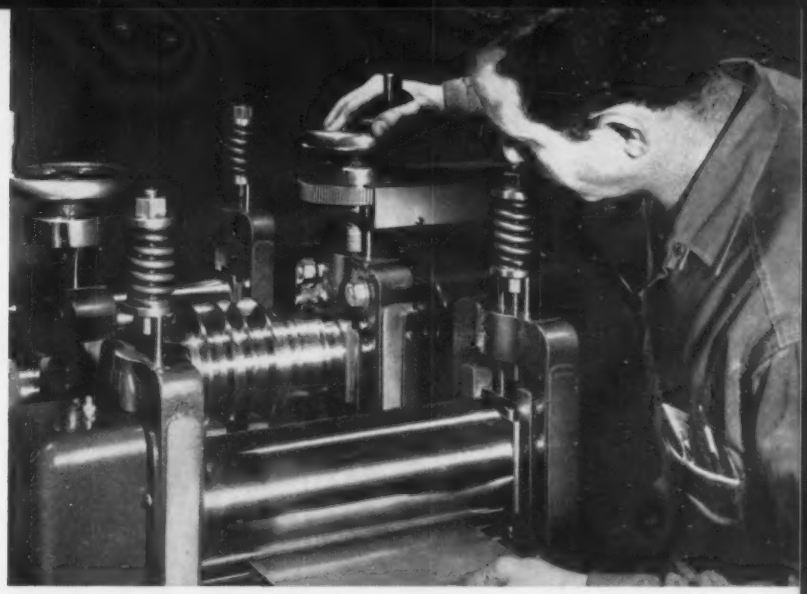
Camera highlights of some interesting operations performed in various metal-working plants

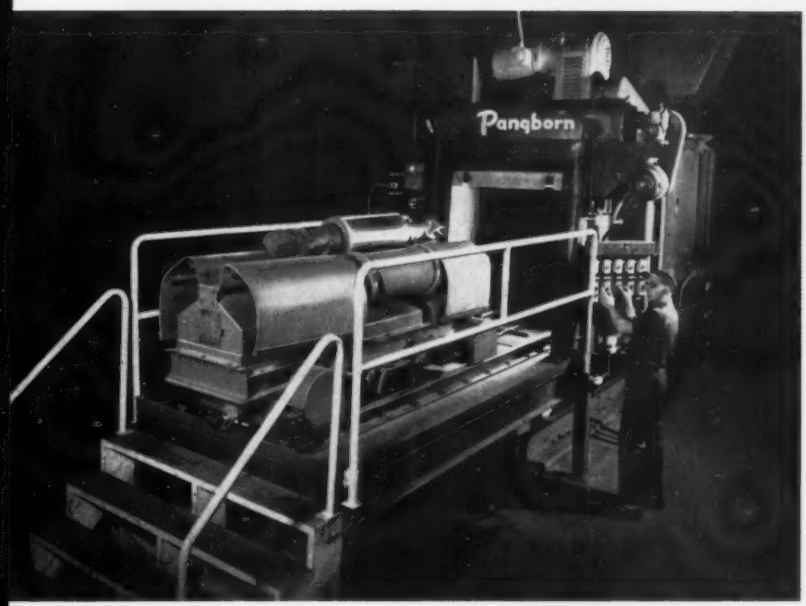
Compound curves are stretch-wrapped in a stainless-steel sheet on a Hufford machine at Convair, San Diego, Calif. A stretch form, molded to the curves desired, is mounted in the center of the machine. The sheet is locked into hydraulically actuated jaws beyond both ends of the form. Pressure is applied by pulling the jaws backward and away from the form, stretching and wrapping the sheet simultaneously.

A 144-inch lathe turns a rotor forging for a 300,000-K.W. steam turbine-generator unit at the West Allis, Wis., Works of the Allis-Chalmers Mfg. Co. The lathe, built by the Consolidated Machine Tool Corporation, measures 60 feet between centers and has a 200-H.P. drive motor. It is one of the largest lathes ever built. The rotor is 5 feet at its greatest diameter, 35 feet long, and weighs about 200,000 pounds.



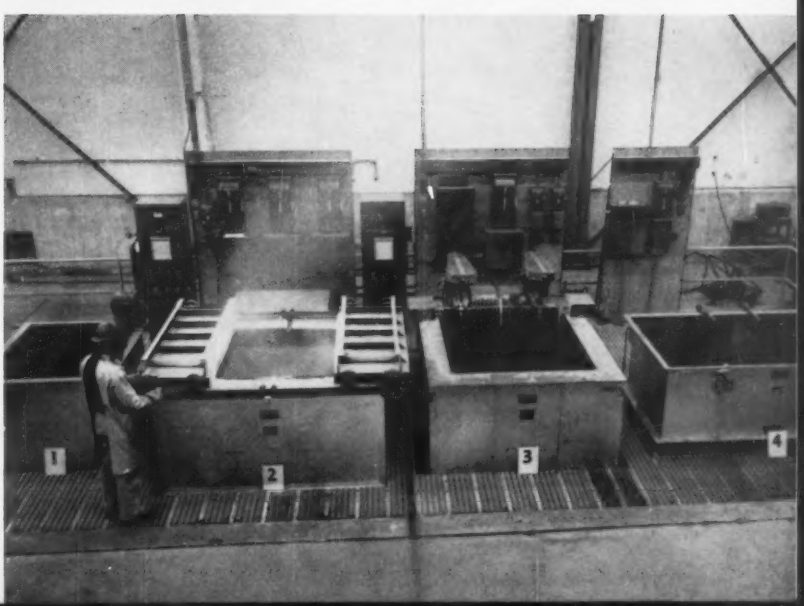
At the Carboloy Department of the General Electric Co., Detroit, Mich., high-temperature alloy coils and sheets are cut to strip on a Stanat rotary gang slitter. The machine can handle stock 8 inches wide and from 0.003 to 0.100 inch thick, holding tolerances to plus or minus 0.001 inch. Having high stress-rupture strength, the alloys are used in gas turbines and jet engines.

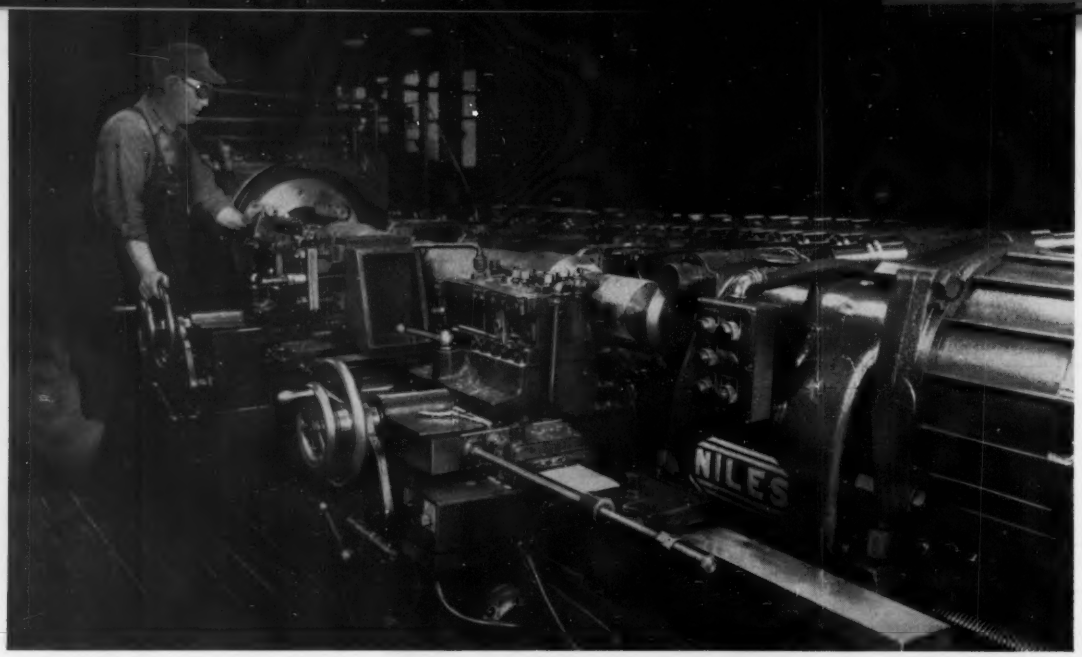




Thomas Strip Division, Pittsburgh Steel Co., Warren, Ohio, obtains a matte finish on its mill rolls by a Pangborn Rotoblast treatment. The roll is cradled in a trolley which rotates it during the operation. In a three and one-half minute automatic cycle, trolley advances into chamber, door closes, blasting is performed, door opens, and trolley returns. Matte finish prevents sticking of coiled strip.

Rohr Aircraft Corporation, Chula Vista, Calif., claims that its new salt bath heat-treating furnaces are the deepest on the West Coast. Designed and installed by Ajax Electric Co., the furnaces martemper long steel aircraft weldments. The four units illustrated are, respectively, an oil-quenching tank, austenitizing furnace, quenching furnace, and hot water rinse tank.





Special-Purpose Lathes Turn and Burnish Railroad Car Axles

NEW machine tools in the Pennsylvania Railroad's Altoona (Pa.) Works have raised production of freight and passenger car wheels and axles to about 38,000 sets annually. These machines, built by the Hamilton, Ohio, Division of the Baldwin-Lima-Hamilton Corporation, consist of two axle turning lathes, two axle burnishing lathes, and a car wheel borer. In addition, B-L-H modified an existing car wheel lathe with hydraulic feeds and tracer equipment. These innovations are part of a long-range modernization program at the Altoona Works. The new machines and equipment have been instrumental in increasing the quality and quantity of work produced, and of equal importance, in decreasing the physical labor involved.

One of the new Niles axle turning lathes is shown in the heading illustration. The practice of turning and burnishing on the same lathe has been abandoned in favor of separate turning and burnishing lathes. This saves the turning equipment from the heavy loads imposed on longitudinal feed-screws by the burnishing operation.

The axle turning lathes have a wide range of speeds and feeds. Cutters are end ground so as to have a line contact, rather than a point contact with the work. In this way, a smooth, easily burnished surface is obtained, instead of a thread-like surface that is rolled over and made under size rather than cold-worked by the burnishing.

Axles are supported between live centers. Three serrated jaws drive the left end of the work. After the heavy cuts have been completed, the jaws are retracted and a light cut is taken to clean up the score marks left by the jaws. (For this, the pressure exerted by the tailstock is sufficient to drive the work.) The tailstock is air-

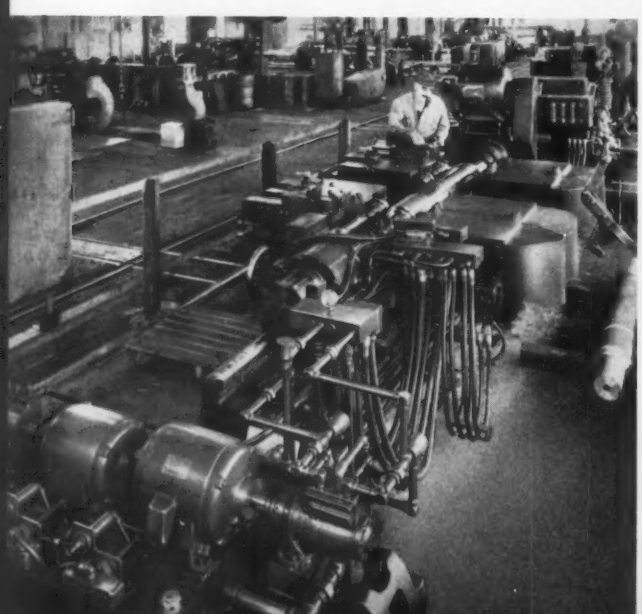


Fig. 1. This special-purpose lathe burnishes the surfaces of the axle with rolls carried on hydraulically powered slides.

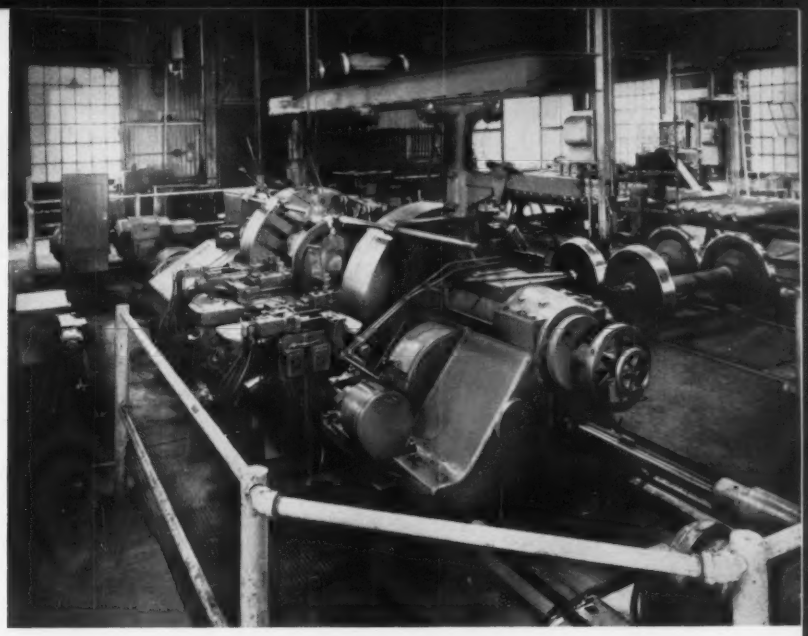


Fig. 2. Car wheel lathe that has been fitted with hydraulic feeds and tracer equipment.

operated—an important factor in reducing loading time to approximately thirty-eight seconds (in contrast to the three minutes required when center-drive type lathes were used).

The lathe illustrated has two carriages, operating either independently or in unison. Multiple tool-blocks on the carriages machine journals, dust-guard seats, and wheel seats. Axles requiring reconditioning are completed at a rate of forty to fifty-five per eight-hour shift. On new axles, the rate is slightly lower—thirty-five to forty-five—because of the preliminary roughing cuts required.

The other axle turning lathe, not shown, is fitted with four carriages. The middle carriages are connected by a tie-rod and move under the direction of a profile bar to develop the contour of the axle body. Follower cams on each carriage are held against the profile bar by air pressure. Roller followers are carried on the rear of the carriages to dampen vibration and eliminate any flexing of the axles.

Other features are a vernier for setting the tools, and a table of computations to indicate the required setting. Each value in the table is a factor of the amount of metal to be removed in regenerating the radius of the wheel seat, and automatically assures a constant dimension between wheel seat sections. It is thus unnecessary to keep a number of model axles as templates.

One of the burnishing lathes appears in Fig. 1, with its hydraulic equipment in the foreground. The burnishing rolls, carried on the hydraulically powered slides, are thrust against the various surfaces of the axle at the desired pressure—from 200 pounds per square inch for end collar and

Fig. 3. Car wheel bores are machined on this special-purpose hydraulic mill.

dust-guard seat surfaces, to 400 pounds per square inch for journal surfaces. The cold-working of these surfaces provides greater service life.

Both burnishing lathes are two-carriage machines. The lathe shown has two pairs of opposing rolls on each carriage, and can burnish axles having either inboard or outboard journals.

The car wheel lathe is shown in Fig. 2. There was no complaint about the performance of the lathe, but moving the tool carriages back and forth manually was an exhausting chore for the operator. Fitting the lathe with hydraulic feeds and tracer equipment eliminated the hard labor, and provided a machine which now turns out from thirteen to seventeen pairs of wheels in an eight-hour shift. Wheel roundness is held to 0.005 inch, well within the requirements of bearings and generator drives.

Tool Engineers Install Officers and Present Honors

Howard C. McMillen was installed as president of the American Society of Tool Engineers at the Society's annual banquet held recently in Chicago, Ill. Mr. McMillen, who is plant manager of Philco Corporation's Bedford, Ind., plant, succeeds Dr. Harry B. Osborn, Jr., technical director, TOCCO Division, Ohio Crankshaft Co.

Other Society officers installed were: H. E. Collins, manager, Process Engineering Department, Hughes Tool Co., Houston, Tex.—first vice-president; G. A. Goodwin, chief process engineer, the Master Electric Co., Dayton, Ohio—second vice-president; Wayne Ewing, president, Arrowsmith Tool & Die Co., Inc., Los Angeles, Calif.—third vice-president; H. Dale Long, president, Scully-Jones & Co., Chicago, Ill.—fourth vice-president; John X. Ryneska, manager of purchasing, General Electric Co., West Lynn, Mass.—treasurer; and William Moreland, vice-president, Meyers Pump Co.—secretary.

Ralph E. Cross, executive vice-president, The Cross Company, received the Society's Engineering Citation for his unusual skill in the development of tool engineering principles. Edward W. Ernst, manager, machine tool equipment and planning, Appliance Park, General Electric Co., received the Joseph A. Siegel Memorial Award for his contributions through leadership, voluntary support, and timely acts of benefit to the Society.

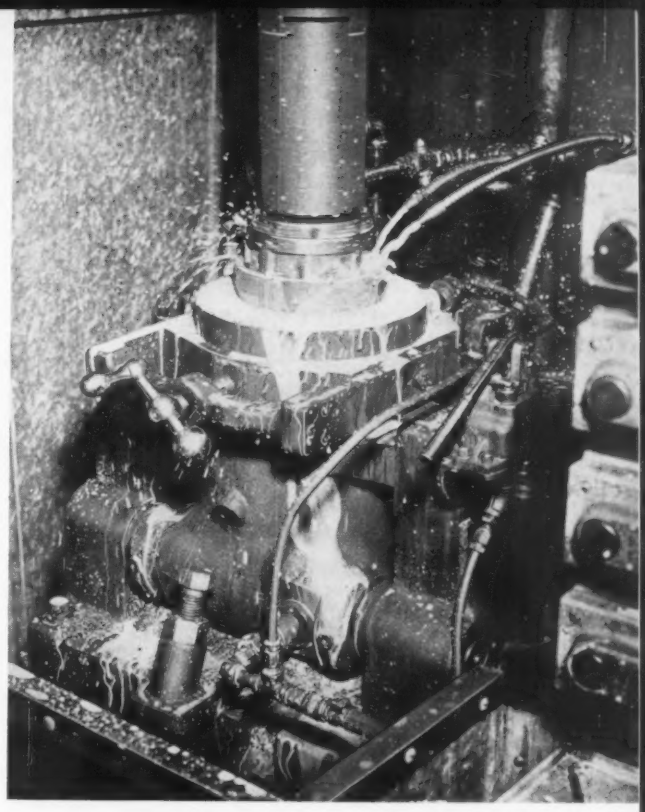
Orlan W. Boston, chairman, department of production engineering, University of Michigan, was presented the ASTE Gold Medal for his outstanding service through published literature, technical writings, and papers. James H. Kindelberger, chairman of the board and chief executive officer, North American Aviation Corporation, received the ASTE Progress Award for accomplishments in the field of manufacturing techniques and production methods.

Officers of the ASTE (seated, left to right) Wayne Ewing—third vice-president; Howard C. McMillen—president; Harold E. Collins—first vice-president; George A. Goodwin—second vice-president; (standing, left to right) Dr. Harry B. Osborn, Jr.—past president; William Moreland—secretary; H. Dale Long—fourth vice-president.

Non-Distorting Chuck Facilitates Machining of Cylinder Liners

Thin-wall tubular liners, cast from Meehanite for use in Diesel engine cylinders, are machined within closer limits because clamping, applied by inflating an air hose, creates uniform pressure even when the external surface is rough

By HERBERT CHASE



ALL Diesel engines built by the Melrose Park Works of International Harvester Co. for crawler-tractor applications are designed to use thin-wall cylinder liners. These liners are Meehanite castings that are rough machined all over. Then, they undergo heat-treatment and are subsequently finish machined to close tolerances to attain as nearly perfect a cylindrical bore as possible.

For internal operations, it is necessary to clamp the thin liner on its outer surface. Until recently, it was impossible to avoid some distortion of the liner during such clamping, regardless of the type of chuck used. Consequently, even a perfectly machined bore would become out-of-round when the clamping pressure was relieved. This difficulty was most serious when clamping the liners for initial boring. In such instances, high clamping pressures were required and yet they could not be uniformly applied, partly because the castings have rough cast exteriors.

To overcome this difficulty, the chief tool designer in this plant designed the "Helimatic" chuck seen in the heading illustration and Fig. 1. Clamping in this chuck is effected by a neoprene (synthetic rubber) hose, 1/2 inch in diameter and having 3/32-inch thick walls. This hose is set in a helical groove in the bore of the chuck.

After the cylinder liner has been placed in the chuck, the hose is inflated with compressed air

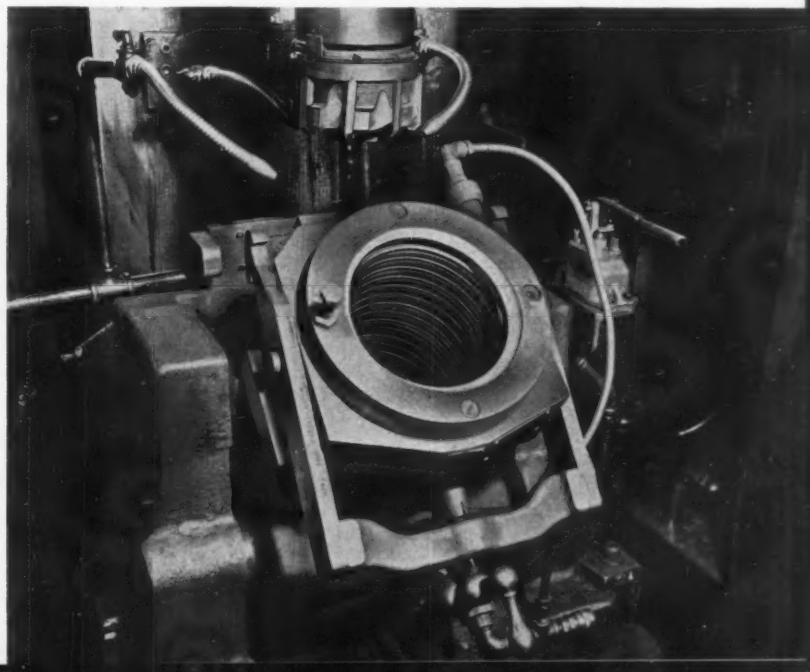


Fig. 1. Neoprene hose, set in a helical groove in bore of this chuck, is inflated with compressed air to grip cylinder liner prior to rough-boring.

from a shop line. In expanding, the hose grips the outer surface of the liner with uniform pressure. Consequently, the work-piece is not distorted. Despite the heavy roughing cut that removes 3/16 inch of metal from the bore, there is no slippage of the sleeve, and the neoprene tube tends to damp vibration caused by the cutting action. No top or bottom support or endwise clamping is required.

The same principle, using a similar hose placed in an external groove on an arbor, was tried for turning the outer surface of the cylinder liner. This arrangement, however, permitted some deflection not found with the boring chuck, and turning is now done with a conventional expanding arbor. If this causes slight distortion, the effects are not detrimental.

After rough machining, the sleeves are put through a salt bath heat-treatment to harden the metal. Thereafter, sleeves undergo honing, using the same basic type of Helimatic chuck employed for boring except that four tubes are provided, each in an individual helical groove. As in boring, the clamping is uniform and completely balanced, there is no distortion, and a cylindrical bore results.

A drawing of the Helimatic chuck is seen in Fig. 2. Body *A* is a steel tube 8 inches in diameter, having a finished bore from 6.225 to 6.231 inches in diameter. The bottom edge of the tubular body is welded to a plate *B*, which is bolted to the chuck base *C*. Four right-hand, helical grooves *D*, 1/2 inch wide, having a semicircular bottom with a radial depth of 0.545 inch, are cut in the bore of the chuck body. Each groove has a lead of 2 1/2 inches. Also, four holes, spaced 90 degrees apart, are drilled tangentially near the bottom of body *A*, so that each hole enters one of the helical grooves. Externally threaded nipples *E* are welded to the outer surface of the body, with the bore of each nipple aligned with one of the tangentially drilled holes.

The four neoprene hoses *F* are inserted in the helical grooves, with their sealed ends at the top of body *A*. The opposite end of each hose is pushed through the bore of one of the nipples *E* and fitted to an inner nipple *G* for supplying compressed air from the shop line. A spring-loaded pin *H* supports a finger-operated lever *J*, which is depressed to lift the cylinder liner *K* from the chuck after the machining operation has been completed.

Any suitable holder can be used for mounting the chuck assembly. If the chuck is to be used on a lathe or other machine where the work-piece must revolve, however, means must be provided for keeping the hoses inflated during rotation. For the rough-boring set-up, the chuck is set in a trunnion type holder so that the assembly can be tilted for convenience in loading and unloading after the cutting tool has been raised sufficiently to clear the work.

It is possible to use a liquid to inflate the hoses, when a compressed air supply is not available, by simply adding a hand- or power-operated hydraulic pump. In fact, the use of synthetic rubber makes it possible to use oil or other liquid without detrimental effect on the hose.

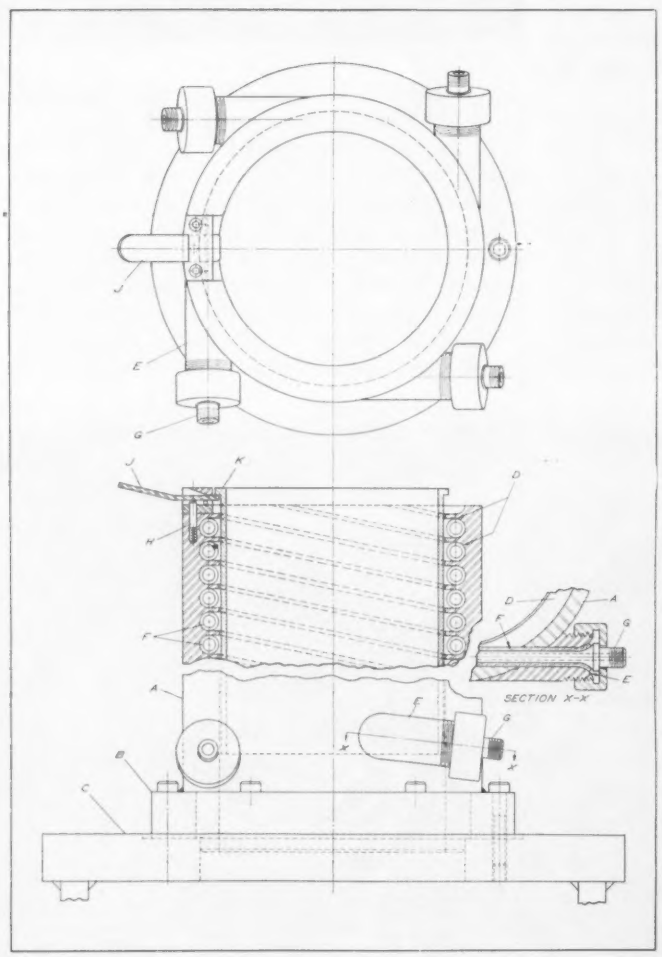


Fig. 2. Drawing of honing chuck which has four neoprene hoses (F) inserted in grooves (D) for gripping outer surface of work (K).

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

A Hidden Barrier to Machinery Sales

"The buyer who neither complains nor praises is our worst barrier to additional sales." The sales manager who made this remark went on to explain that he sold small machines wherein repeat purchases were usually spread well apart. "When the buyer complains, we can hop to it quick. When we don't hear from him one way or another, we just can't afford the cost of a personal sales call."

This sales manager related that while traveling with a sales engineer they happened to pass a plant which had bought a machine one year previously. Stopping to call, they found the machine out of use. "It works all right," the buyer exclaimed, "and our men know how to operate it. But they don't think its use justifiable over the old method."

The installation was correct, the machine could perform, but the post-selling job had never been done. Above all, the buyer neither complained, nor enthusiastically trumpeted its successful use to others.

What with competition and the urge to meet a sales quota, there are many cases where a sales engineer does not follow up an installation to see that maximum results are obtained. Pressure to make additional sales blocks the added sales effort required to yield enthusiastic satisfaction.

While working with a machinery selling agency just starting up, the writer was asked to point out a few basic principles. They are:

Keep your overhead down.
Bid only on jobs that will show profit.
Make sure that every installation continues to give its full measure of service.

The last principle is the most important one because customer satisfaction is the most highly prized asset. It can only be won by a systematic follow-up on every installation.

Each one of us has probably bought a major electrical appliance that cost a few hundred dollars. But how few of us have ever received the simplest inquiry questioning its operation and our satisfaction. It is difficult to understand why not more customers and distributors employ the technique of follow-up in building their business.

The capable sales manager will adopt some form of efficient follow-up on every installation made. The first requirement of a follow-up plan is to maintain an accurate record of each installation, together with pertinent information. One company keeps such a master record, both at headquarters and at the field office. It is available to salesmen, servicemen, and those in charge of sales promotion.

The most economical and effective method of follow-up should be devised. In the case of sizable purchases, it is the sales engineer's duty to personally check the success of the installation. In the case of small standard equipment, a telephone call or a telegram or letter will usually suffice.

One manufacturer sends out an attractively prepared return post card every year. Another company mails a carefully worded letter of inquiry and encloses selling literature on other types of machines sold by the concern. Being directed to an individual, the returns usually run high. Replies include calls for service, and requests that a sales manager call in connection with possible additional purchases.

Harness the arts of sales promotion with those of personal inquiry. Is the customer satisfied, and if not why? Is service needed, or additional equipment contemplated? A plan such as this can create good will, uncover dissatisfaction, and furnish valuable sales references with selling opportunities.

The follow-up plan should be relentlessly carried out to the end, so that every installation becomes a silent selling force. Each sales engineer should not only be trained in the importance of customer satisfaction, but be held responsible for effectively carrying out plans to achieve this. A system such as this soon loses its punch unless the sales manager periodically checks its progress and evaluates results. The follow-up that keeps customer relationship alive, yields additional business.

MACHINERY'S PROBLEM CLINIC

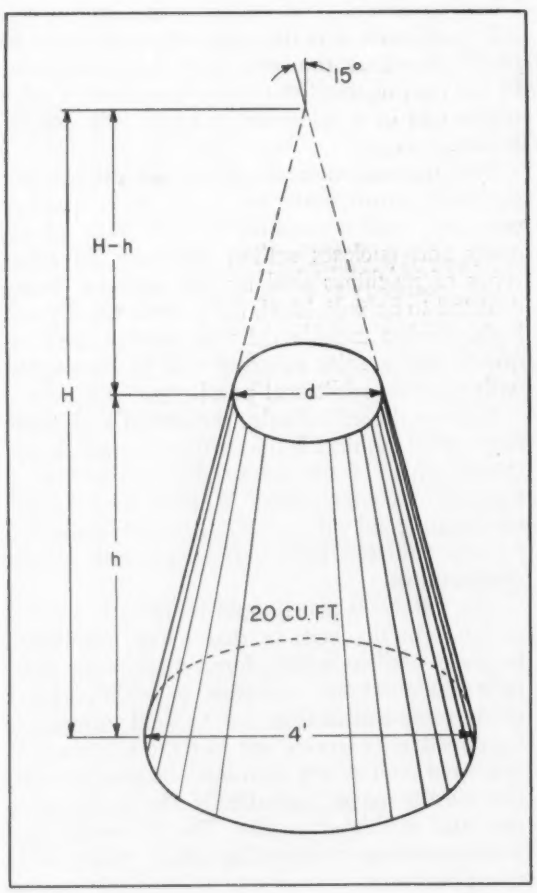
Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Dimensions of a Cone Frustum for a Specified Volume

By STANLEY P. GOULD, Porterville, Calif.

A storage tank in the shape of a frustum of a cone has a base diameter of 4 feet and a slant angle of 15 degrees. What would be the height h and the top diameter d for a capacity of 150 gallons (approximately 20 cubic feet, since 1 cubic foot is equal to 7.48 gallons)?



The height (h) and diameter (d) of the cone frustum (shaded section) are determined by applying three simple rules.

Solution:

One direct method for solving this problem makes use of three simple rules:

A. The height of a cone is equal to 1/2 the product of the base diameter and the cotangent of the slant angle.

B. The volume of a cone is equal to 0.2618 times the product of the height of the cone and the square of the base diameter.

C. The volumes of cones having the same taper are in the same proportion as the cubes of their base diameters.

These rules are used in the following step-by-step solution:

1. $H = 1/2 \times 4 \times \cot 15° = 2 \times 3.732 = 7.464$ ft.
2. Volume of large cone $= 0.2618 \times 7.464 \times 4^2 = 31.265$ cu. ft.
3. Volume of small cone = volume of large cone − required volume of frustum $= 31.265 - 20 = 11.265$ cu. ft.
4. $\frac{\text{Volume of large cone}}{\text{Volume of small cone}} = \frac{4^3}{d^3}$, according to Rule C, so that

   $d^3 = 4^3 \times \frac{11.265}{31.265} = 23.06$

   $d = 2.85$ ft.
5. $H - h = 1/2 \times d \times \cot 15° = 1/2 \times 2.85 \times 3.732 = 5.318$ ft., according to Rule A.
6. $h = H - (H - h) = 7.464 - 5.318 = 2.146$ ft. = height of frustum

Check using standard formula for the volume of a cone frustum:

$$V = 0.2618\, h\, (D^2 + d^2 + dD)$$
$$= 0.2618 \times 2.146\, (4^2 + 2.85^2 + 4 \times 2.85)$$
$$= 19.97 \text{ cu. ft.}$$

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Rotary Scrap-Stripping Device

By H. B. SCHELL, Brooklyn, N. Y.

One step in the manufacture of cardboard cartons is the die cutting of the developed form. Each printed carton blank is joined to the adjacent carton and to the scrap material surrounding the end flaps by means of small tabs. A typical lay-out, Fig. 1, shows the arrangement of the die-cut shapes on the web, or continuous cardboard strip; the scrap material, depicted by shading; and the tabs, indicated by two parallel lines.

Upon completion of the die-cutting operation, the scrap pieces must be removed from the web. This procedure, known as stripping, is frequently carried out by hand. However, the rotary scrap stripper shown in Fig. 2 has been designed to replace this manual operation.

The main member of the device is a cylindrical housing *A*. This housing is driven at the same surface speed and is the same diameter as the printing cylinders that are located ahead of the cutting dies. Cam *B* is stationary, being mounted on a fixed portion of the machine by means of bracket *C*. An arcuate slot in the bracket permits adjustment of the cam position.

Scrap pieces are picked out by a hook attached to follower arm *D*. This arm pivots on shaft *E* which fits into a bearing hole bored through an integral housing lug. On the other end of the arm is a cam-follower *F*. Because arm *D* and its associated parts rotate with the cylindrical housing, tension springs *G* are necessary to overcome the centrifugal force developed during normal operation and maintain the cam-followers in contact with the cam surface. A clearance opening *H* is provided for each hook.

It is apparent from the lay-out of the carton blanks on the web that there is a periodicity about the occurrence of the scrap pieces and, therefore, that they will always contact the same area on housing *A*. Because of this, one or more hooks are located within each contact area.

During normal operation, follower *G* rides up on the cam lobe as the leading edge of the scrap

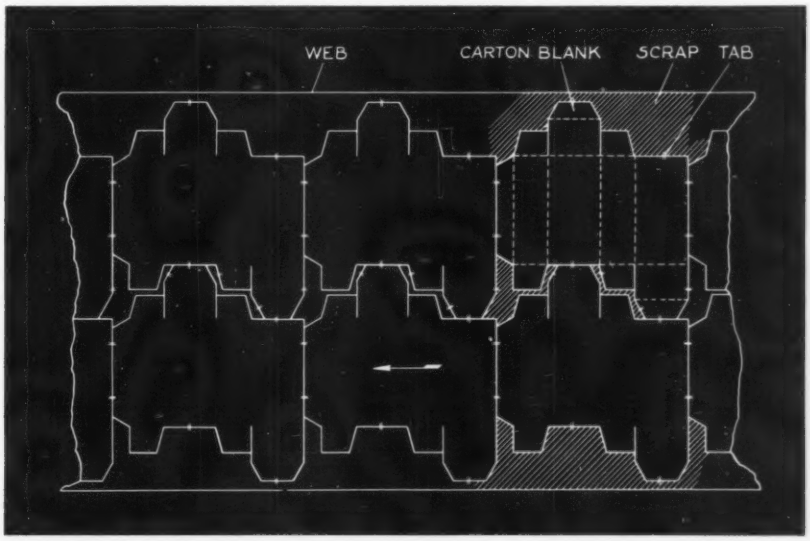


Fig. 1. Cardboard web lay-out showing die-cut carton blanks and the attached scrap material.

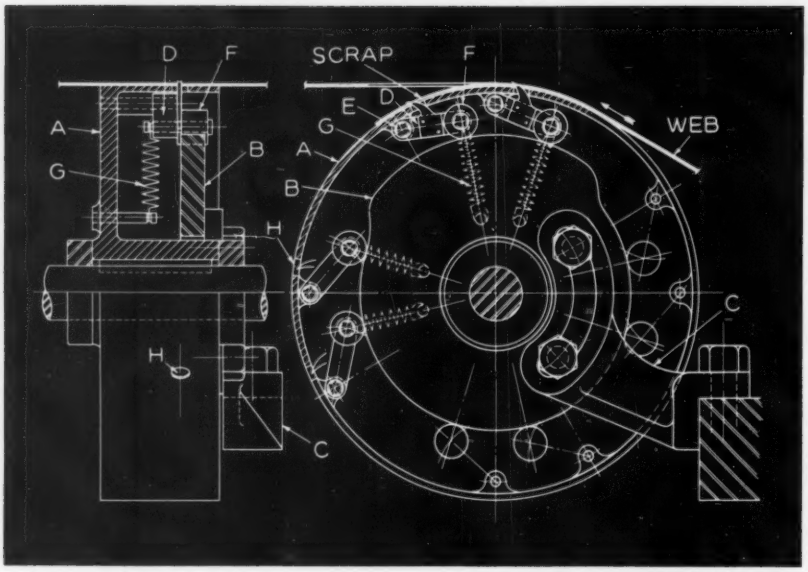


Fig. 2. A rotating unit strips scrap material from a die-cut web on a production line handling cardboard cartons.

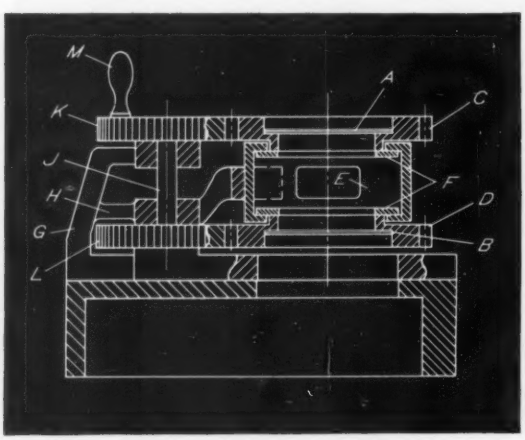
piece contacts the housing. Follower arm *D* is raised just enough to allow the hook to puncture the scrap piece and remain there while the follower is in contact with the cam lobe. As the web leaves housing *A* in a tangential path, the scrap material is retained by the curved hooks. This division in paths of travel causes the tabs to break, thus effecting a separation between the carton blanks and the unwanted trimmings. After the cam-followers leave the cam lobe, the hooks are withdrawn, and the scrap is free to fall into disposal cans.

Simple Gear Drive for a Polariscope

By Paul Grodzinski, London, England

In conventional polariscopes, the object to be inspected is placed between two polaroid discs. Usually, the discs are stationary and the specimen is rotated to obtain thorough inspection.

It would, however, be more desirable to have the specimen remain stationary and the discs rotate. The difficulty with this method is that no direct connection between polaroid discs *A* and *B* is possible due to the interference of the specimen holder. This drawback can be overcome by providing an external drive that will produce a synchronous movement of both discs.



In the illustrated device, discs *A* and *B* are mounted in holders. These holders are, in turn, contained within bored recesses in gear wheels *C* and *D*. The gear wheels bear against the flanged ends of tubular housing *E*, being retained in contact by rings *F*. Housing *E* is held solid with the frame *G* of the polariscope by arm *H*. Passing through a boss on arm *H* is a vertical shaft *J* carrying two spur gears, one at either end. These gears, *K* and *L*, mesh with gear wheels *C* and *D*, respectively. A handle *M* is provided on gear *K*. When the handle is moved, gear wheels *C* and *D* will rotate synchronically.

Simple gearing arrangement provides synchronous movement of two independent polaroid discs.

Cam-Jaw Chucks for Twisting Rod

By Oscar Nagelis, Santiago, Chile

Two chucks having cam jaws furnish a powerful grip on a machine which twists steel rod used in reinforced concrete. One of the chucks, Fig. 1, anchors one end of the rod. The other, Fig. 2, rotates the opposite end of the rod to produce the required twist.

The anchoring chuck has a bracket *A* mounted on the frame of the machine. Rod *B* to be twisted is located against a pad *C* transversely movable within the bracket by means of a toggle arrangement with lever *D*. At two other points on its periphery the rod is under the pressure of knurled cam jaws *E* and *F*. A link *G* joins the jaws so that they can pivot in unison around their respective shafts *H* and *J*. Extending from the link is an operating arm *K*.

When slipping a rod into position in the machine, lever *D* and arm *K* occupy the positions illustrated. The arm is then moved down, and the jaws pivot counterclockwise, to lock the end of the rod against the pad. As the machine starts to twist the opposite end of the rod, the cams tend to tighten their grip. To release the rod, lever *D* is lowered. This action causes locating pad *C* to retract.

The driving chuck, Fig. 2, has two cover plates *L* and *M*, tied together by bolts *N*. The outside of each plate is turned down to form integral bearing diameters *O* and *P*. Diameter *P* is bored to receive the end of rod *B*. Located between the cover plates is a large gear *Q*. This gear has two hubs; each is drilled radially and beveled at three points to receive the lobes of cam jaws *R*. The jaws pivot on bushings *S*, which are mounted over the bolts *N*. Also, the two rows of jaws are separated by a disc *T*.

When the machine is running, a pinion, which is engaged to the gear, rotates it in the direction indicated by the arrow. The cam jaws immediately pivot in and start twisting the rod, the opposite end of which is fixed in the anchoring chuck. To release the twisted rod, the gear is reversed momentarily. Like the cam jaws in the anchoring chuck, those in the driving chuck have knurled bearing surfaces to provide a better gripping action.

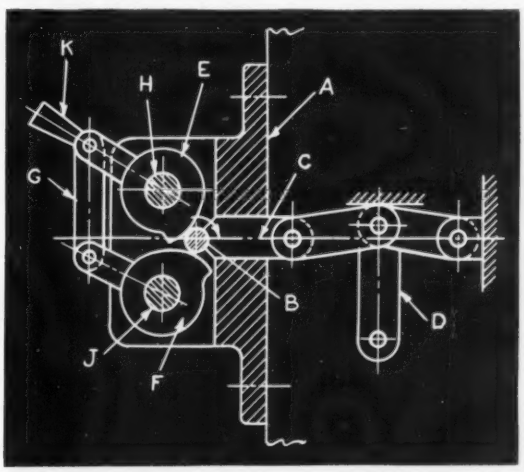


Fig. 1. (Above) This anchoring chuck prevents one end of the steel rod from rotating.

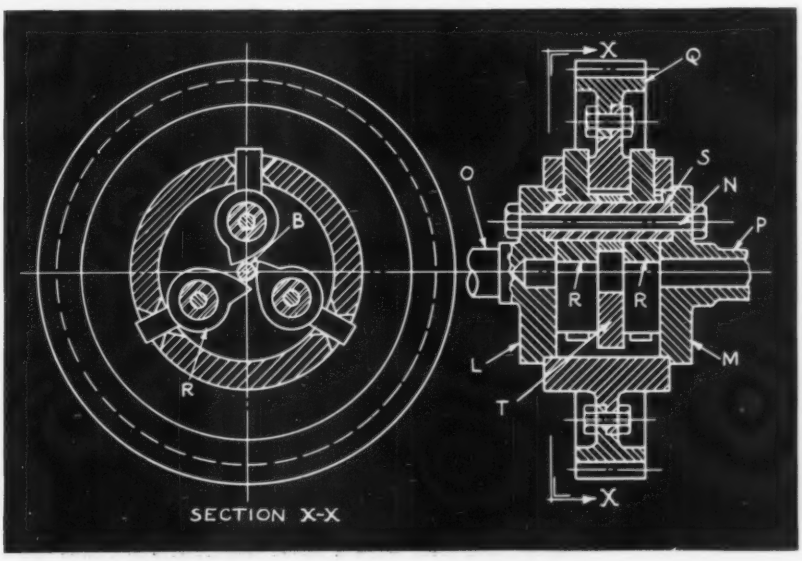


Fig. 2. (Right) The driving chuck rotates the opposite end of the rod to produce the required twist.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

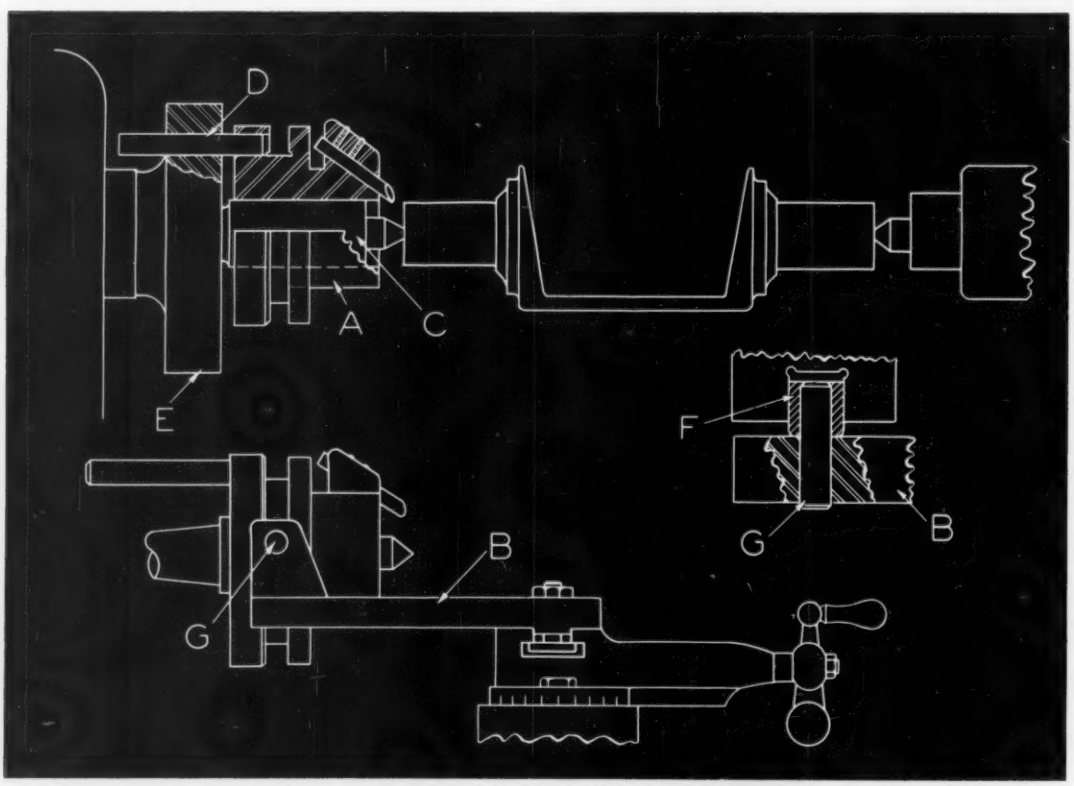
Rotating Lathe Cutter-Head Designed to Machine Awkward Trunnions

By H. J. GERBER, Stillwater, Okla.

A swing cutter-head designed to turn trunnions on a structural steel work-piece having an extension too long to be rotated on a machine tool is shown in the accompanying illustration. The trunnions are welded to opposite sides of a structural steel channel 6 feet long. Used on a medium-sized engine lathe, the special cutter-head proved economical for the amount of work machined.

After laying out and drilling center holes on an axial line common to each of the trunnions, the work is placed between the headstock and tailstock centers of the lathe. The long channel arm is supported by a steel trestle set on the floor behind the lathe.

Rotation of the lathe spindle turns the cutter-head body *A* as it is carried along the work longitudinally by link *B* which connects the body with the tool-rest on the carriage. Body *A* is a snug sliding fit on arbor *C*, and the latter is provided with a tapered shank to fit the headstock spindle.



Rotary cutter-head which is moved longitudinally in a lathe operation

The cutter-head is driven by a pin *D* which is located in driving plate *E*. An annular groove around the periphery of the body serves as a track for roller *F* which rides on pin *G*. When the carriage feed is engaged, body *A* is traversed longitudinally along the work, and, at the same time, rotates to make the cut. The trunnions are machined for about one-half their length.

The correct setting of the tool bit for both the rough and finish cuts can be made by the use of a stepped gage bar held between centers. In chamfering the sharp corners on the ends of the trunnions, the hand feed is used.

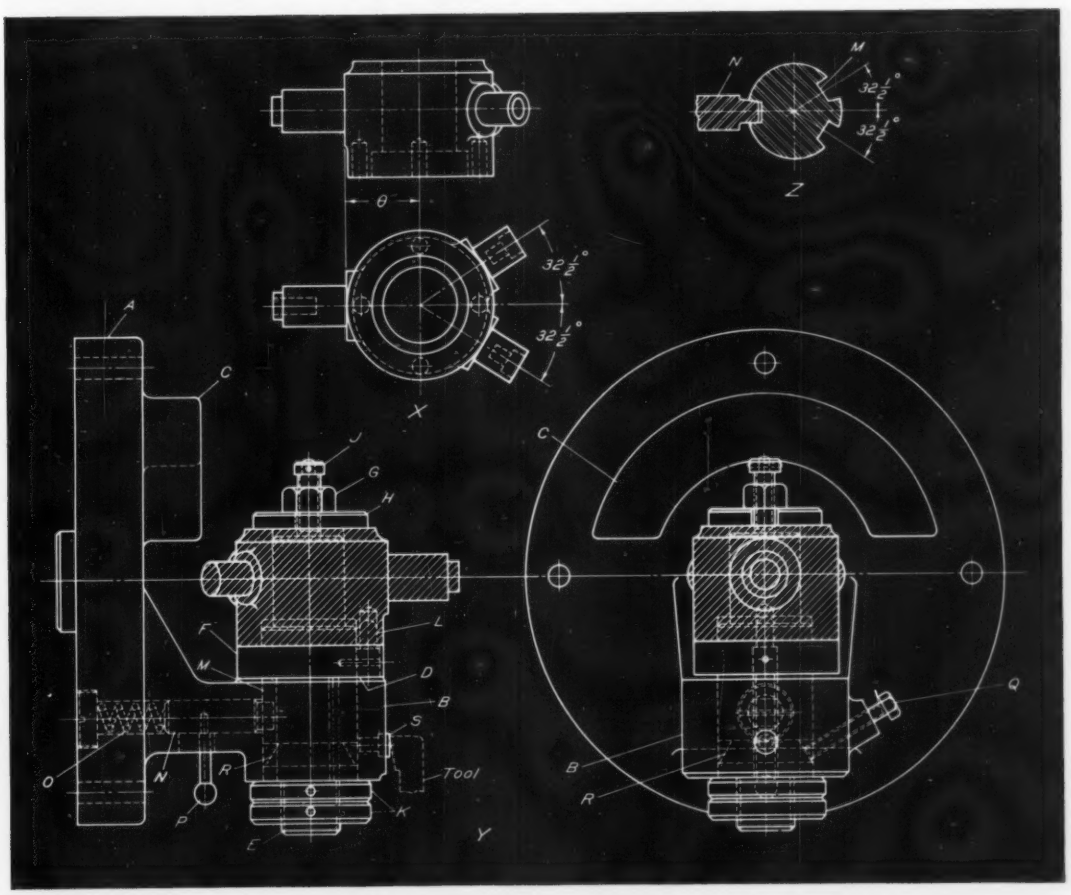
The work is turned end-for-end to machine both trunnions. However, because the job is performed with the work held between centers, the axial alignment of both trunnions can be maintained readily.

Indexing Type Lathe Fixture for Machining Projections

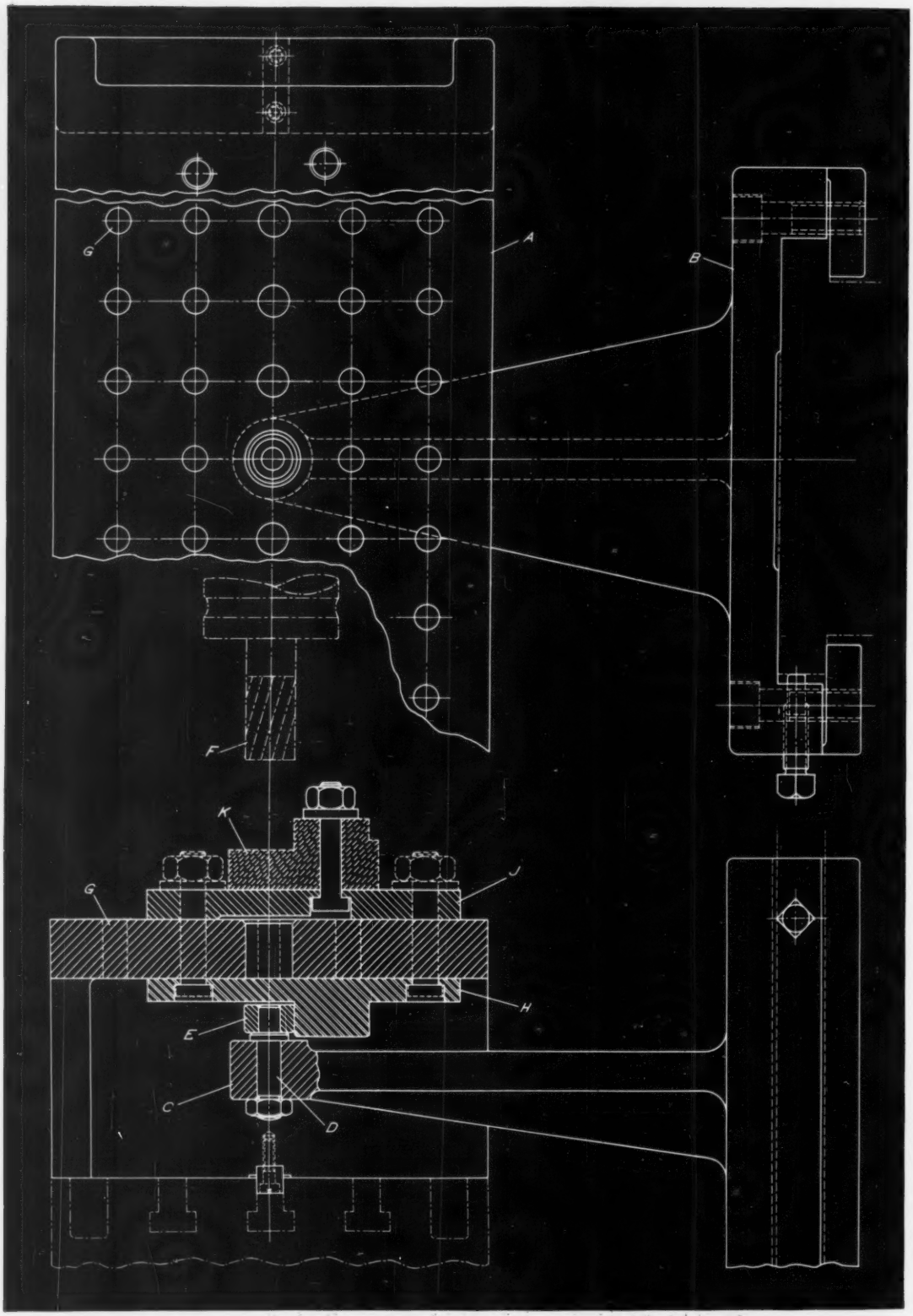
By W. M. HALLIDAY, Southport, England

An indexing type lathe fixture speeds the machining of projections on the axle-bracket casting shown in view X of the accompanying illustration. Operations involve turning, boring, and shoulder-facing the projections. Previously, both walls of the casting are faced, the core step-bored, and four blind holes accurately jig-drilled and reamed in the base. The shoulders of all three projections are the same distance (θ) from center. The projections themselves are in the same horizontal plane, but not equally spaced radially, as illustrated.

A drawing of the fixture, supporting the casting in machining position, appears in view Y. Disc *A*,



Indexing positions of shaft (E), to which the work-piece is secured, are controlled by engagement with plunger (N).



Holes (G) in box table (A) permit template (H) and work fixture (J) to be tied together in proper relationship.

centered and mounted on the lathe faceplate, has an integral arm *B* and counterbalance *C*. The upper surface of the arm is a flat pad *D* normal to the lathe faceplate and at a predetermined distance from the lathe spindle center line. A bore, running through the arm, receives the shank of a hardened shaft *E*. Approximately midway in its length, the shaft has a shoulder *F* which bears on the pad and, in turn, supports the work-piece. The height of this shoulder is such that the center line of the projections coincides with that of the lathe spindle.

Above the shoulder, the shaft is turned down to receive the step bore of the casting. A nut *G*, threaded over the end of the shaft, and C-washer *H* secure the work-piece in position. To remove the work-piece, the nut is loosened and the washer slipped off. A small collar *J*, pinned to the shaft, prevents unintentional removal of the nut.

The lower end of the shaft extends through the pad *D* and is threaded for a pair of lock-rings *K*. These rings permit the shaft to be indexed in the arm, but with a minimum amount of endwise float. Each projection is machined in sequence, with the work-piece and shaft indexing as a unit. For this, one of the blind holes in the base of the work-piece is located over a pin *L* pressed into the shoulder of the shaft.

To control the three-position index of the shaft, it has three identical grooves *M* milled into the portion within the pad. A cross-section of this area appears in view Z. Lying laterally within the arm is a plunger *N*, the end of which enters the grooves of the shaft. A spring *O* keeps the plunger normally engaged. Both the end of the plunger and all three grooves have one straight wall and one inclined wall, to assure accurate indexing and automatic compensation for wear, see view Z.

Indexing is performed manually, after retracting the plunger by a small lever *P*. This lever passes through a slot in the arm and is pressed into the body of the plunger. The shaft is clamped tightly to the pad by a set-screw *Q* threaded to an angular boss on the rear of the arm. The tip of the set-screw bears against an annular groove *R* in the shaft cut at a corresponding angle.

Radially aligned with pin *L* is a hardened and ground button *S* in the arm. The exposed end of the button is in the vertical plane required of the projection shoulders. Thus, the button serves as a guide for the tool position when setting a longitudinal stop for the lathe carriage.

This type of indexing fixture can be used for other applications by accommodating the work-piece on a suitable shaft that is cut with the proper number of grooves.

Roll Follower for a Vertical Milling Machine

By J. U. BERGMARK, Karlstad, Sweden

A roll follower device that features an auxiliary box table simplifies working from a template on a column and knee type vertical milling machine. As can be seen in the accompanying illustration, the box table *A* has an open side; and, when mounted on the machine table, the open side faces the column.

Clamped to the vertical knee slide is a bracket *B*, the arm of which projects through the open side of the box table. In constructing the device, a boss *C* on the end of the arm is bored from the machine spindle to receive a roll stud *D*. A roll *E*, having an outside diameter corresponding to that of the end mill *F*, is fitted over the top of the stud. A series of equally spaced jig-bored holes *G* permits matched templates beneath the table and work fixtures above the table, such as *H* and *J*, respectively, to be tied together by dowel-pins and bolts in proper relationship. The work-piece *K*, in turn, is secured in place by a bolt passing upward through a T-slot in the fixture.

In use, the operator adjusts the machine table until the template contacts the roll, then employs coordinate movements of the roll-feed and cross-feed handwheels to follow around the roll. Although the template is not visible to the operator, he soon acquires the proper "feel." For roughing cuts, a roll is used that has a slightly larger outside diameter than the end mill.

* * *

National Screw Machine Products Association Elects Officers

Clarence A. Button, assistant to the executive vice-president of the Mueller Brass Co., Port Huron, Mich., was elected president of the National Screw Machine Products Association at its recent annual meeting in Milwaukee. Elected vice-president was Dana B. Jefferson, Jr., president of the Walker Mfg. Co., Medfield, Mass. The Association's new treasurer is Leonard R. Schaffer, president and treasurer of Mechanical Art Works, Inc., Newark, N. J. Orrin B. Werntz was re-elected executive vice-president of the Association, whose headquarters is in the N.S.M.P.A. Building, Cleveland, Ohio.

Ideas for Shop and Drafting-Room

Scaling Enlarged Drawings to Actual Size by the Photo-Process

By GEORGE G. HERZL, Philadelphia, Pa.

Experience has proved that seeing the parts of delicate instrument designs in actual scale aids in getting a true perspective of the relative positions of the parts. Considerations such as shock resistance, stiffness, and transportability, rather than determination of stress analyses, are of prime importance.

But it is difficult to account for these conditions by calculation. Visualizing an assembly drawing in true scale helps to determine these qualities and aids in making enlarged detailed drawings of the parts.

However, the production of such small drawings by hand is difficult. By photographing an enlarged assembly drawing, which has been scaled, a negative is developed. The image on the negative is then projected on photo-paper calibrated to the true scale of the assembly. When the calibrations projected from the negative and those on the photo-paper correlate, the picture is taken and developed.

The resulting photograph is an accurate scale drawing presenting the distinctive features of the enlarged drawing. Distortion due to the photographic process is negligible.

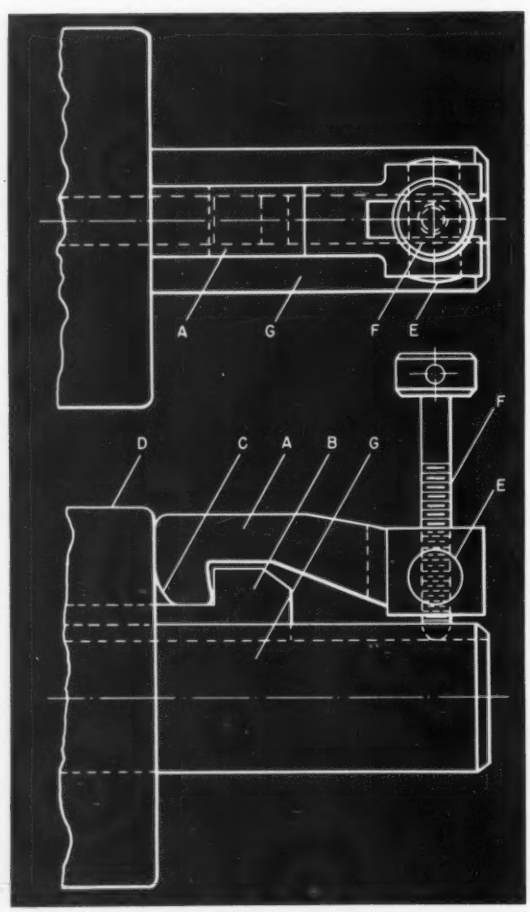
Simple Extractor for Gib-Head Keys

By WILLIAM MORSON, Birkdale, England

One of the obstacles encountered in machinery maintenance is the removal of gib-head keys. This is especially true if they have been incorrectly fitted or if only a minimum amount of space has been left between the head of the key and the face of the pulley or gear being secured. Under these conditions, it is difficult to apply the conventional type of extractor tool having claws or prongs for gripping the head of the key.

The tool illustrated provides safety, ease of application, and ample extracting force. Member *A*, the body of the tool, may be machined from either steel or malleable iron. It is stepped on its left-hand end to form a claw which engages gib-key *B* from behind. This portion of the body should be slightly wider than the width of the largest key to be handled. The claw should be thick enough to fit snugly into the space, as shown at *C*. A domed end provides a rocking surface, or fulcrum, where the body contacts pulley *D*.

A hardened steel rod *E* is fitted into the forked, close-drilled portion of body *A* to provide a pivot point. The rod is drilled and tapped to receive pressure screw *F*. Holes are drilled around the head of the screw to accommodate a spanner wrench so that sufficient pressure may be applied to the extractor. The opposite end of the screw is turned down and rounded to fit into the keyway of shaft *G*. Tightening screw *F* will cause member *A* to rock upward, thus forcing the key out of position.



Extracting tool that permits removal of gib-head keys in close quarters

Questions and Answers

A service to readers who have questions pertaining to the metal-working and machine-building industries

Is There a Handy Method of Judging Aluminum Temperatures?

W.H.C.—Since aluminum does not show any "color" at temperatures up to its melting point, it is difficult to estimate its degree of heat. Are there any handy methods of determining when aluminum parts have reached correct heat-treating temperatures?

Answered by Technical Editorial Service Reynolds Metals Co., Louisville, Ky.

Yes, "Tempilstiks" will be found helpful in determining aluminum temperatures when heat-treating or preheating prior to welding. These are crayons with which you make a mark on the aluminum surface. As the temperature of the aluminum is increased gradually, a point will be reached where the crayon mark will melt and assume a "wet" appearance. This indicates the work has reached the temperature rating of the particular Tempilstik you have used.

Tempilstiks are available with temperature ratings from 113 to 400 degrees F. at approximately 13-degree intervals and from 400 to 2000 degrees F. at 50-degree intervals.

Excessive Truing of Grinding Wheels

E.B.A.—We believe that we are truing some of our grinding wheels too frequently. What is the probable cause and the remedy?

Answered by Gus Wickstrom Norton Co., Worcester, Mass.

Excessive truing, or dressing, may be caused by a wheel that is too fine or too hard for the job, or one that is too coarse or too soft. Symptoms of a wheel that is either too fine or too hard are slow cutting action, excessive grinding heat, and poor surface finish.

There are four possible remedies for these conditions: First, use a wheel of coarser grit, softer grit, or both. Check the type of abrasive and bond to be sure that both are suitable for the material being ground. Second, check the diamond truing tool to be sure that the diamond is of adequate size and presents a sharp edge to the wheel. Third, be sure that the diamond is being used at the proper depth of cut and rate of traverse across the wheel to assure effective dressing. Finally, inspect the diamond nib if the wheel is trued frequently because of glazing or dulling. The diamond should be rotated in its holder at regular intervals to present a sharp cutting edge to the wheel. Wheels will also tend to glaze if the depth of cut is too shallow or the table speed too slow.

If excessive truing is the result of the wheel being either too coarse or too soft for the job, the following symptoms will probably be evident: inability to maintain the required production rate due to wheel breakdown shortly after truing; rapid corner wear when grinding up to a shoulder, especially where no under-cut is present; and difficulty in maintaining work size because of rapid wheel breakdown. As a remedy, change to a finer grit or a harder wheel grade. If the wheel loads excessively during wet-grinding of non-ferrous metals, a change of grinding fluid or a change in the concentration of the fluid being used is recommended.

Breach of Contract Without Damages

C.W.P.—Is a seller liable to the purchaser of machinery for breach of a contract if the purchaser suffered no damages?

Answered by Leo T. Parker, Attorney at Law Cincinnati, Ohio

Although a purchaser is dissatisfied with merchandise, he cannot recover damages unless he proves the amount of damage. For example, in Moran vs. Levin, [63 N. E. (2d) 334] a purchaser sued a seller, claiming that the latter misrepresented the quality of the merchandise. The purchaser, however, failed to prove any financial losses resulting from the alleged fraud, and the higher court refused to hold the seller liable in damages. The court held that a purchaser does not have a case, based on fraud, unless he furnishes a rational and adequate basis for the ascertainment and assessment of the actual damage that resulted to him.

Texas Plays Host to Machine Tool Builders

MACHINE tool builders must learn to sell the function of machine tools in the national economy, in addition to selling machines, Louis Polk, president of the Sheffield Corporation, and president of the National Machine Tool Builders' Association, told members of the Association at its Fifty-Fourth Spring Meeting, held at the Shamrock-Hilton Hotel in Houston, Texas, March 27 to 29. "From the standpoint of the general public," he said, "the function of machine tools is, first, to raise the standard of living without severe unemployment and similar dislocations. Hand in hand with this belongs our second function—to serve as a basic arm of national defense. To fulfill these essential functions, we must maintain continuous programs of research and development. Unless we obsolete our own models with new and better machines, fulfillment of our economic function becomes impossible," Mr. Polk continued. "And we must reach broader segments of executives both in industry and in government. It is right to sell a foreman on a new electronic control—but we must not overlook selling the president of a company upon the wisdom of keeping equipment modern and effective. The shop superintendent is rightly interested in the elimination of a secondary operation —but it is equally important to sell the controller of a company on a program of reducing costs."

Dudley C. Sharp, Assistant Secretary of the Air Force, summarized his department's views on industrial readiness and the machine tool modernization program. One of the most important aspects of industrial readiness, he claimed, concerns the machine tool problem. Machine tool availability is the keystone to the success of the Air Force in achieving timely production for new weapons or in expanding over-all production.

Mr. Sharp placed the current inventory of Air Force-owned machine tools at 145,000 units, with 100,000 of them in active use by contractors. To retire and replace obsolete machine tools, the department has been allocated $70,000,000. "The machine tool modernization program, together with the long-range requirement for continuing superior air power, gives . . . an opportunity to move out of the vicious feast-famine cycle that has plagued us all," Mr. Sharp contended.

Graham E. Marx, executive vice-president of the G. A. Gray Co., and chairman of the Association's Government Relations Committees, commented on the "death" of the Vance Plan, saying, "We believe that the whole machine tool problem is cloudy because of the continuing debate amongst the long versus short war strategists. Notwithstanding this issue, we have continued to emphasize . . . that regardless of the type of any future war, machine tools will play a vital part in our over-all ultimate effort."

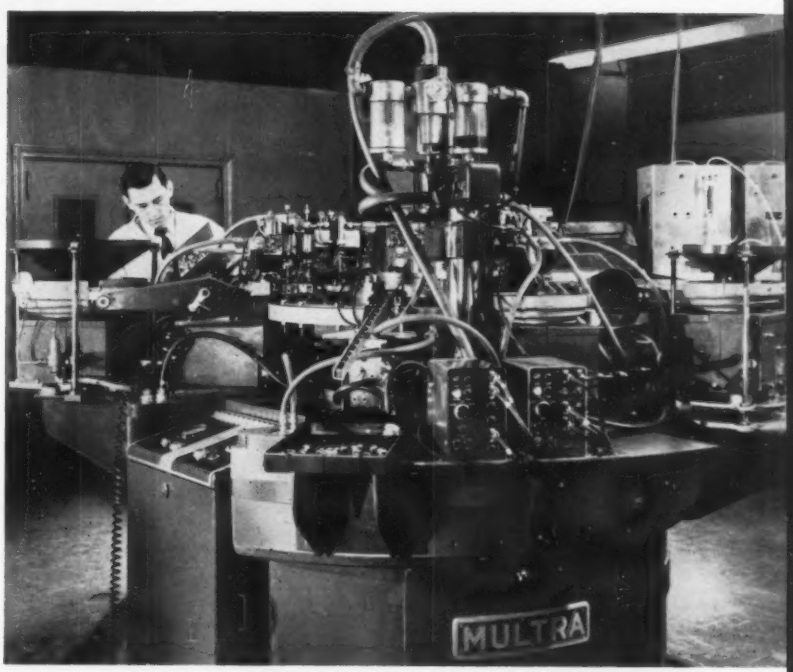
Through joint government-industry effort, the trigger contract program has attained fruition, Mr. Marx reported. The "trigger" contract calls for immediate commencement of a high rate of machine tool production should an emergency arise. A $21,000,000 fund, earmarked for the program, provides working capital advances up to 30 per cent of the value of the items to be produced, if commercial assistance is not available.

Leasing of government-owned machine tools is being confined to supplement defense production, reported Joseph P. Crosby, second vice-president of the Lapointe Machine Tool Co., and current director of the Metalworking Equipment Division of the Commerce Department's B.D.S.A. This division is recommending an increase in the government's leasing rate that is comparable to the rates of private lending agencies. He said, "We have informed the Office of Defense Mobilization that industry feels the rental rate of 1 per cent per month is unfair competitively to both the machine tool builders and industry in general . . ."

"Training for the Future of the Machine Tool Industry" was the title of a paper by Urwin Rowntree, director of education of the Brown & Sharpe Mfg. Co. A reappraisal of traditional training techniques is necessary, Mr. Rowntree said. Training should be more closely geared to job requirements and need not follow a formal "time serving" program. Most important, training should recognize the importance of individual differences among the trainees.

Measuring machine tool capability by statistical probability is one way in which the Ford Motor Co. is cooperating with the machine tool builder, said Irwin A. De Grote, staff supervisor of quality analysis of Ford's Engine and Foundry Division. Mr. De Grote said his company, before accepting a machine, is able to rate its performance right in the builder's plant. He continued that it is advantageous to the builder to have the machine performance rated in this way.

Flexibility Featured in Automatic Assembly Machine

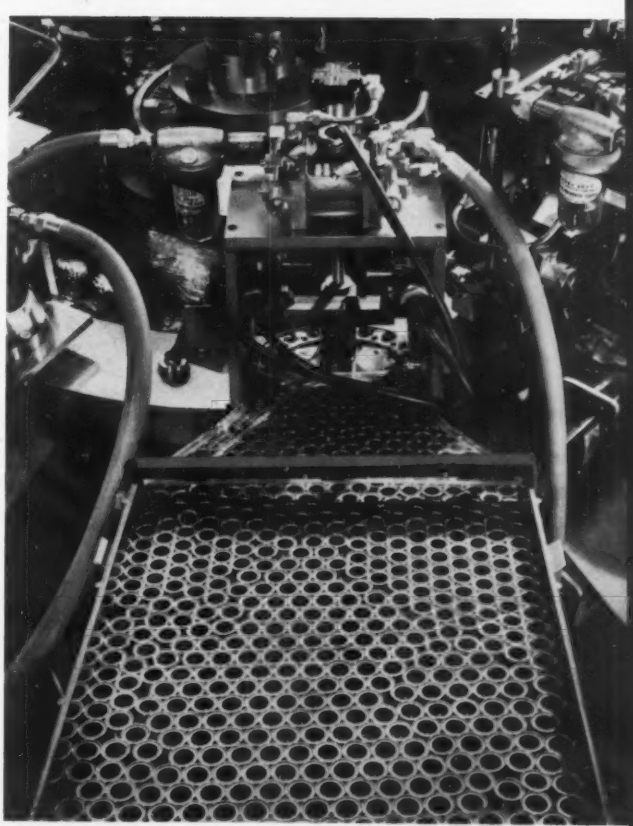


A NEW multiple-purpose automatic assembly machine is turning out between 15,000 and 20,000 mercury batteries during each eight-hour shift at the North Tarrytown, N. Y., plant of P. R. Mallory and Co., Inc. One feature of the machine is that by retooling, which can be accomplished in a few hours, other products can be assembled.

Designed and built by the Multra Corporation, a subsidiary of Barnes Engineering Co., Stamford, Conn., the machine automatically performs all of the battery assembly operations that normally require an operator. It feeds, sorts, sizes, forms, orients, and inspects five different battery parts. These parts include such varied forms and materials as metal cylinders and caps, felt absorbent, neoprene grommets, pressed metal, and a liquid electrolyte that is metered into the battery assembly.

A feed-back system is built into the machine. If a part should fail to be inserted at any one of the stations, the particular sub-assembly with the missing part is rejected at a later station—meanwhile, no additional parts are fed into it.

The machine, which weighs more than 7000 pounds, carries the battery sub-assembly from one work-station to another where parts are inserted or work is performed. Parts are fed from work-nests that are located at the work-stations. The machine can be indexed with an accuracy of plus or minus 0.002 inch. Although there is provision around the 6-foot diameter work-table for sixteen tooling stations, not all of them are used for the battery assembly operation.



Metal cans are being fed to the work-table of an automatic assembly machine at Station 3. The parts are selected from a tray by a feed-wheel and then transferred into the sub-assembly by an air-operated plunger.

LATEST DEVELOPMENTS IN *Shop*

Seneca Falls Platen Type Automatic Lathes Developed to Handle a Wide Variety of Work

Three sizes of platen type automatic lathes, designed primarily for chucking operations, have been brought out by the Seneca Falls Machine Co., Seneca Falls, N. Y. These machines are adaptable to a wide variety of work requiring large swing capacity, high spindle speeds, multiple tooling, and fast cycling operation. The lathes are fully automatic, cam-operated, and have adequate tool support for heavy work.

They can be provided with the Seneca Falls automatic loading and transfer equipment, which can be used for the automation of individual machines or a series of machines arranged for successive though dissimilar operations. Thus, work-loading, machining, and work-transfer operations can be combined in one automatically controlled system.

The tool-blocks are mounted on a power-operated cross-slide. Movement of this slide is controlled by the manufacturer's "Quick Change-over Mechanism" which has been developed to eliminate the necessity of changing cams for variations in the length of stroke. The cross-slide base is keyed and bolted to the platen and is adjustable longitudinally by T-slots which permit quick positioning. The automatic longitudinal feed for the platen is obtained through a barrel-cam located in the bed of the machine.

The machining operations performed by the Model LN platen type automatic lathe shown in Fig. 1 consist of turning, boring, facing, and chamfering the open end of a torque converter housing. The workpiece is a steel stamping that is held and driven by an air-operated "air-phragm" chuck having "wrapping" jaws designed to prevent distortion of the work. The 45-degree angle on the inside diameter of the flange is generated by combining the longitudinal- and cross-feeds through an independent tool-slide fitted to the rear tool-block as illustrated in Fig. 2.

The tool equipment used on another Model LN platen type automatic lathe for machining the hub on the opposite end of the workpiece shown in Fig. 2 is illustrated in Fig. 3. The chuck which grips the outside of the flange machined in the previous operation is of the same type as the one used in the first operation. The inside of the hub is bored to the required diameter and chamfered, and the open end is faced with tools mounted on the rear tool-block, while the outside is contour-turned to size with a template-controlled tool mounted in the front tool-block.

The Model N platen type automatic lathe has a swing of 11 inches over the platen; the Model LN lathe

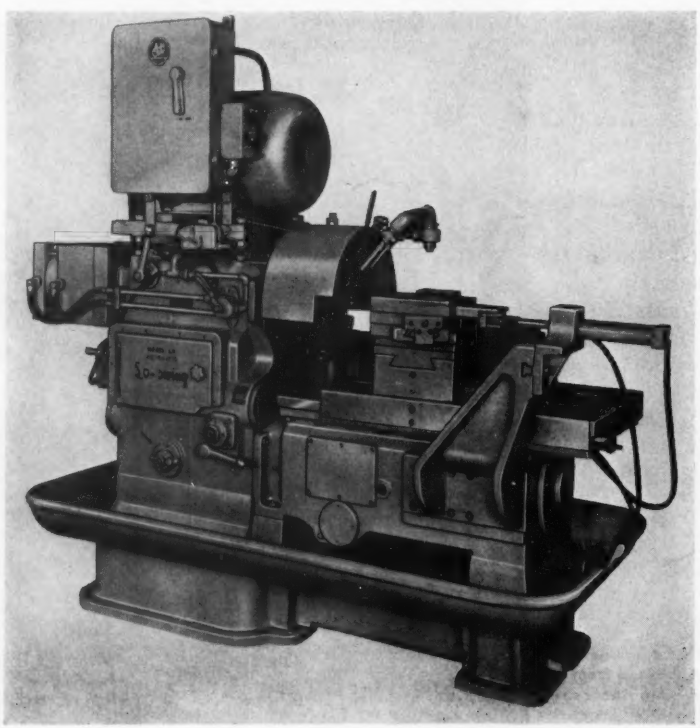


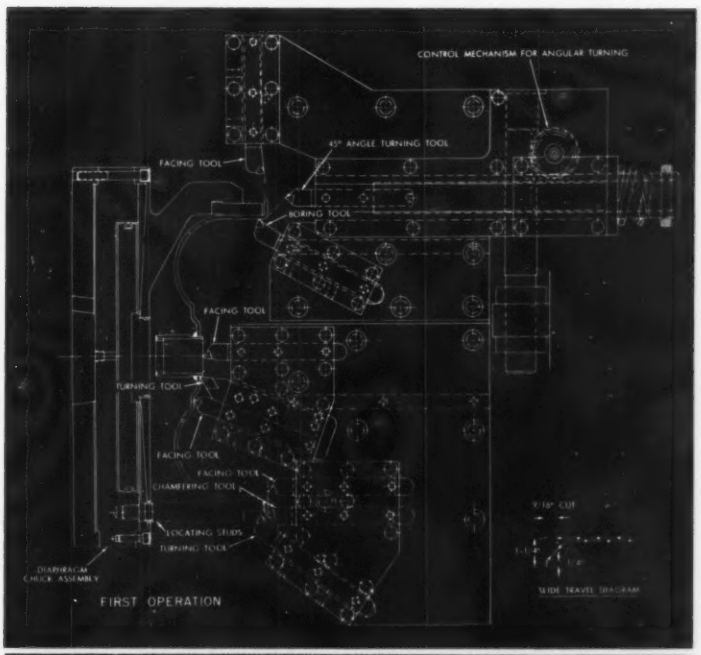
Fig. 1. Over-all view of the Seneca Falls Model LN platen type automatic lathe adaptable to a wide variety of work

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Fig. 2. Tool lay-out employed on lathe shown in Fig. 1 for first machining operation on the torque converter impeller housing



illustrated has a swing of 18 inches; and the Model AN has a swing of 24 inches. The rated capacities of these lathes are 5, 20, and 40 H.P., respectively.

Circle Item 101 on postcard, page 219

Kennametal Steel-Cutting Carbide for High-Speed Machining

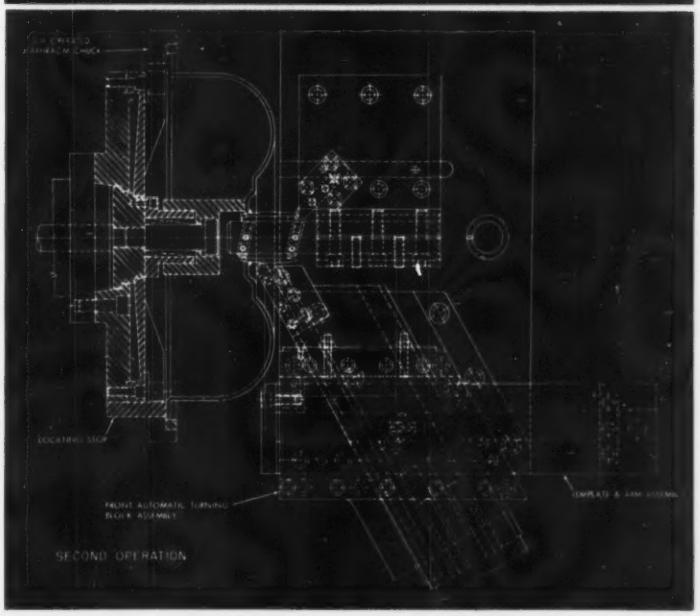
A new steel-cutting grade carbide, K7H, for high-speed machining at light to moderate feeds is being introduced by Kennametal Inc., Latrobe, Pa. This new grade tool material is intended for all types of finishing operations. It is especially suited for profiling applications and may be applied on practically any modern machine capable of operating over wide ranges of feeds and speeds.

K7H is a carbide with exceptional hardness (93.5 Rockwell A) and unusual strength—even at high temperatures. These characteristics, along with maximum resistance to cratering and high edge-wear resistance, are said to facilitate machining materials such as high-tensile steel alloys, Inconel, 400-series stainless steels, and nickel base alloys.

Due to its extreme hardness, K7H is being produced only in button or throw-away type inserts. These inserts are now available for many styles of Kendex tools, and stocks are being extended rapidly.

Circle Item 102 on postcard, page 219

Fig. 3. Tool lay-out for second machining operation which follows operation performed by set-up shown in Fig. 2

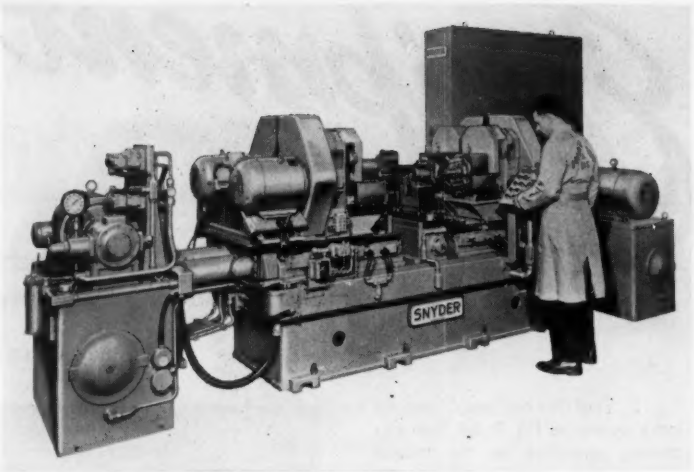


Snyder Two-Way Precision Boring Machine

A versatile, eight-spindle, two-way precision boring machine that finishes nineteen different parts with a variety of bore sizes and center distances is announced by Snyder Tool & Engineering Co., Detroit, Mich. The machine shown has two fixtures for holding cast-iron power take-off transmission cases that enable the boring of up to four holes at each fixture location and the production of a finished part at each cycle of the machine.

Each two-spindle boring head is a separate slide unit and can be operated manually, automatically, individually, or in combination with other heads in an automatic machine cycle, thus providing maximum flexibility of operation for parts made in small quantities. A finished part can be produced in an automatic cycle in fifty seconds floor-to-floor time on this electrically operated, hydraulically controlled machine.

Individual hydraulic cylinders power each head unit. Hydraulic power is provided by separate motor, pump, and tank units at each end of the machine. A 3-H.P. motor drives the two spindles in each head. Two speeds can be had on the lower spindle of each head, and three speeds are possible for the upper spindle by adjusting belts. A timing belt is provided on the low-speed spindle to avoid slippage of drive.



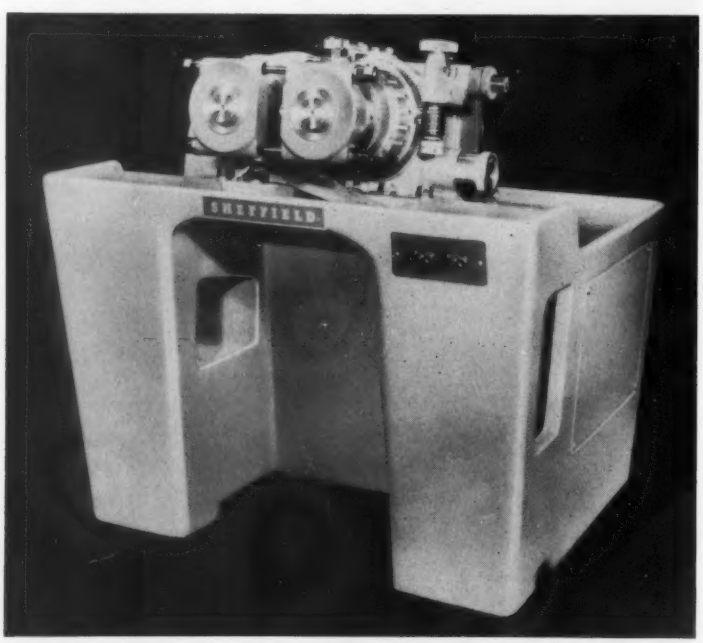
Eight-spindle, two-way Snyder precision boring machine designed to handle nineteen different finish-boring jobs

Electrical controls are in a panel at the rear, and all push-button controls are in a compact panel at the operator's position. The machine occupies a floor space of about 15 by 5 feet and is 5 feet high.

Circle Item 103 on postcard, page 219

Sheffield Thread-Rolling Machine

A new type thread-rolling machine for high-production threading of studs, machine screws, and other work-pieces is announced by the Sheffield Corporation, Dayton, Ohio. Equipped with hopper feed, this machine will roll threads on up to 5200 parts per hour with thread sizes ranging from 1/8- to 3/4-inch outside diameter by 2 inches long. Rolling is performed by two interchangeable and reversible precision-ground rolls rotating at different speeds. The rolls are mounted on heavy-duty, roller-bearing spindles and are driven under positive worm and worm-wheel control by a 7 1/2-H.P. motor. The desk type base of the machine is 3 by 4 feet; has operator knee room; and houses the motor, coolant tank, and pump.



Thread-rolling machine announced by the Sheffield Corporation

Parts are fed tangentially between the rolls by a revolving feeder ring and, on completion of the threading operation, roll down a chute into a container. The feeder ring can be magazine-loaded manually or automatically. Equalized roll wear is said to be assured by the different speeds and timing of the feeder ring. Pitch-diameter adjustment is accomplished by a precision lead-screw that advances the right-hand roll and spindle through a micrometer type unit. Timing of the rolls is infinitely adjustable.

Rolls are available for any type thread form within the following size ranges: 0- to 1/4-inch outside diameter by 2 inches long; 5/16- to 7/16-inch outside diameter by 1 1/2 inches long; and 1/2- to 9/16-inch outside diameter by 1 1/4 inches long.

Circle Item 104 on postcard, page 219

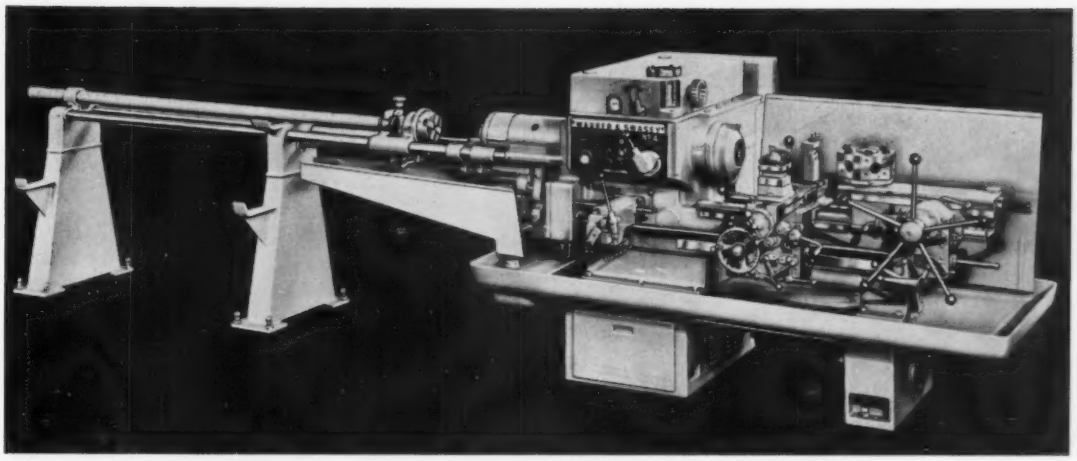


Fig. 1. No. 4 universal ram type turret lathe with simplified operating controls introduced by the Warner & Swasey Co.

Warner & Swasey Universal Ram Type Turret Lathes

Simplified operating controls and faster speed changing—through the use of an all-hydraulic headstock—are among the advantages claimed for two universal ram type turret lathes introduced by the Warner & Swasey Co., Cleveland, Ohio. The No. 4 lathe, Fig. 1, and the No. 5 lathe, Fig. 2, are said to provide adequate balanced power and maneuverability for high-production metal turning. Both machines are fully adaptable to existing tooling and, in addition, can be used with the latest special turret lathe attachments.

The operator's controls are zoned, with one lever at the headstock actuating all speed changes; and another lever providing forward, reverse, brake, or free-spindle operation. A headstock-mounted, direct-reading speed preselector—calibrated in revolutions per minute, surface speeds, and work diameters—makes possible rapid selection and use of the proper spindle speeds.

The headstock, which completely eliminates gear shifting through the use of constant-mesh helical gearing and direct-acting hydraulic clutches, provides instantaneous spindle-speed changes through the single speed-control lever. The hydraulic clutches require no wear adjustment, and their smooth, shockless operation is said to insure trouble-free headstock performance.

Spindle-speed control by the preselector dial is accomplished by means of a mechanical-hydraulic system. When the preselector dial is rotated to the desired speed calibration, a pair of coordinated selector discs is mechanically aligned in readiness to actuate a combination of four hydraulic shuttle valves. A touch of the speed-control lever causes the shuttle valves to direct oil pressure to the required clutches in the headstock. Speed changing is instantaneous. The spindle is equipped with an 8-inch American Standard Type "A-1" flanged nose.

Six reversible power feeds—cross and longitudinal—are provided with automatic feed trips in the compact feed apron. The square turret is indexed automatically. The hexagon turret revolves on a pre-loaded, precision-tapered roller bearing which causes the turret to rise slightly during indexing, eliminating wear on the seating surfaces.

The hexagon-turret feed apron has provision for transmitting six power feeds to the turret-slide. These feeds can be halved or doubled by using a set of optional gears in the head-end gear-box. Adjustable stops are provided to automatically trip the feeds for each turret face.

The newly designed hydraulic collet chuck and bar feed, available on both lathes, are designed for heavy-duty operation. A single lever controls both the bar feed and collet, with a gage provided to indicate the tightness of the collet grip on the bar.

Twelve spindle speeds, or twenty-four unduplicated spindle speeds with a two-speed motor, in a 62.2 to 1 over-all range, are standard on both the No. 4 and No. 5 universal

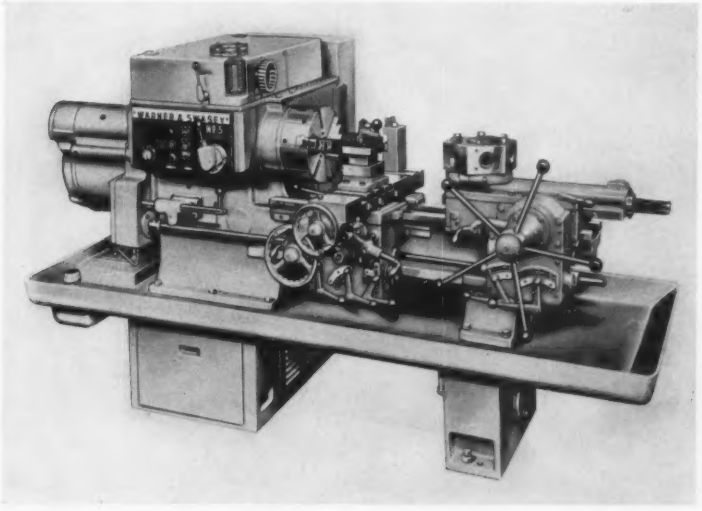


Fig. 2. No. 5 Warner & Swasey universal ram type turret lathe

lathes. Speeds on the No. 4 lathe range from 30 to 1866 R.P.M. with a 15- or 7 1/2-H.P. drive motor. The No. 4 universal ram type turret lathe swings 18 1/8 inches over the bed and 9 1/2 inches over the cross-slide. The No. 5 lathe swings 20 inches over the bed and 10 1/4 inches over the cross-slide.

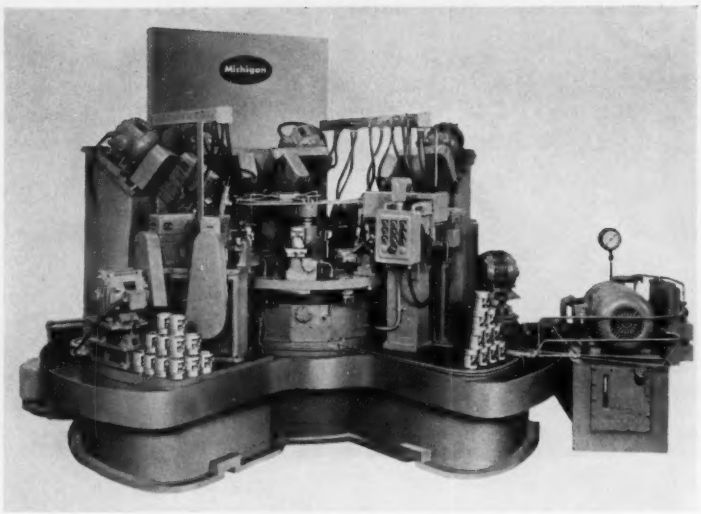
Circle Item 105 on postcard, page 219

Long-Stroke Aluminum Extrusion Press

The Lake Erie Engineering Corporation, Buffalo, N. Y., has built and installed the first in a series of 2300-ton, four-column, long-stroke aluminum extrusion presses. This self-contained, hydraulically operated machine is capable of extruding billets from 6 to 9 inches in diameter and up to 30 inches in length at speeds up to 48 inches per minute. It takes rectangular and round billets. Fast approach speeds of 825 and 760 inches per minute reduce non-productive time. Controls are completely interlocked, and semi-automatic operation is provided for when either flat or bridge type dies are being used.

Outstanding features include: rigid, box type end platen; swinging die arm; rigidly guided vertical shear; auxiliary shear slide; container with inserted type resistance heaters; radially supported container holder and moving cross-head; and inserted cast steel main cylinder.

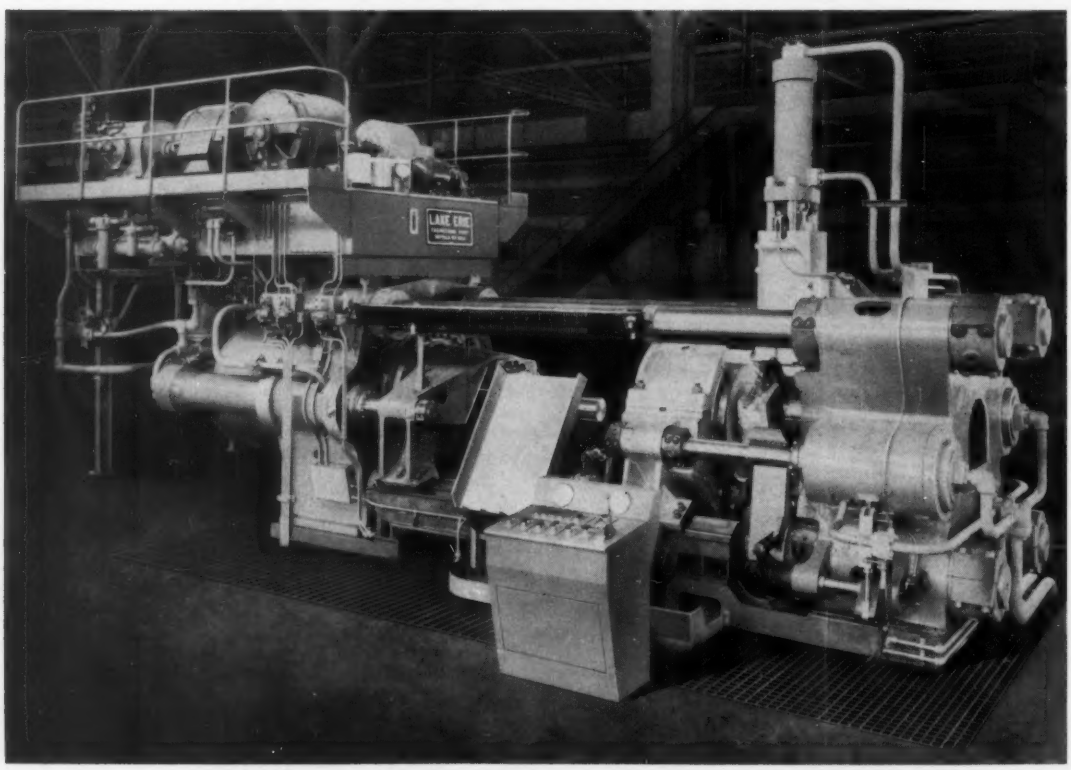
Circle Item 106 on postcard, page 219



Special piston-drilling machine built by Michigan Drill Head Co.

Special High-Production Piston-Drilling Machine

Michigan Drill Head Co., Detroit, Mich., has brought out a special machine which finish-drills 1200 pistons per hour. During each complete cycle of the machine, it performs ten



Lake Erie long-stroke aluminum extrusion press designed for semi-automatic operation

separate operations on each piston: finish-drilling four angular holes and finish-drilling six horizontal smoke holes.

This is an eight-station, horizontal and angular, dial type machine. It has a Michigan drill head; automatic hydraulic index-table; and individual automatic indexing fixtures. Attached to the standard, 42-inch hydraulic index-table is a mounting plate 60 inches in diameter, on which the indexing fixtures are mounted. The automatic indexing fixtures make it possible to drill the odd angular holes, as well as the horizontal smoke holes, on one machine. The completed pistons are ejected automatically at the eighth station. Provision is made for hydraulic power clamping of fixtures and fully automatic cycle control from station to station. The machine is built to J.I.C. hydraulic and electrical standards, and is provided with automatic lubrication.

Circle Item 107 on postcard, page 219

Double-Crank Open-Back Press

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, recently built a double-crank, open-back press mounted on adjustable legs that permit operation in an inclined position, discharging finished pieces by gravity through the open back. The press is of the single-geared, single end-drive type. It is equipped with an electrically controlled, air-operated, drum type friction clutch with spring-loaded brake. The flywheel is fitted with an auxiliary air brake to bring it to a quick stop when the power is shut off. The machine has a pneumatically counterbalanced slide and a centralized, manually operated lubrication system.

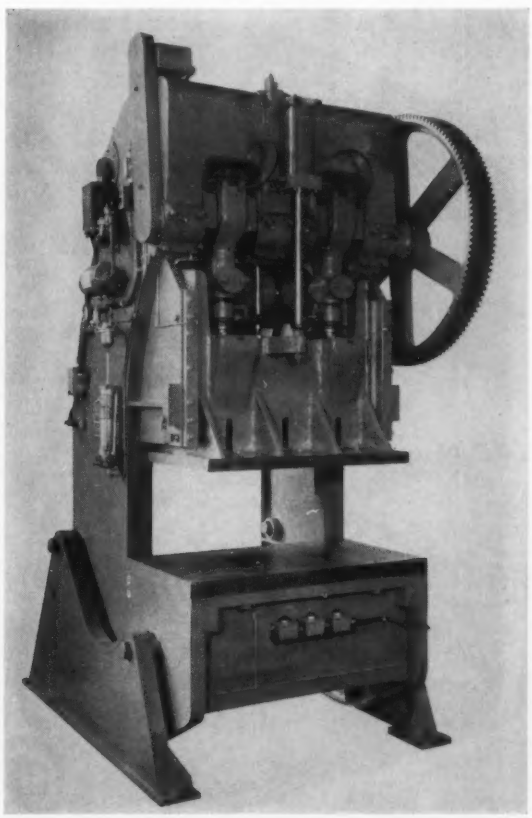
The press illustrated has a capacity of 250 tons, a stroke of 16 inches, and slide adjustment of 10 inches from bed to slide with the ram in the down-stroke position, and an adjustment of 37 inches with the slide in its top position. Bed area is 42 by 72 inches, and a pneumatic cushion, which has a capacity of 42 tons at an air pressure of 100 pounds, is provided.

Circle Item 108 on postcard, page 219

Electronic Measurement Gage Stamps Code Letter on Pistons

An electronic gage that measures taper and outside diameter of automobile pistons and then stamps a code letter on each piston to identify the size classification has been introduced by Federal Products Corporation, Providence, R. I. This gage measures both the taper between the top and the bottom of the piston skirt and the outside diameter at the upper end of the skirt simultaneously. If the taper measurement is not within tolerance limits, the classifier element will ignore the diameter measurement, causing the part to be rejected.

If the taper is within acceptable limits, it is grouped in one of six diameter classifications differing by plus or minus 0.0003 inch. Signal



Cleveland open-back press with provision for operating in an inclined position

Federal electronic gage that automatically measures and stamps code letters on pistons

lights enable the operator to see at a glance the classification of each piston. A code letter indicating the diameter is automatically stamped indelibly in ink on each piston. This method of marking is said to drastically reduce both assembly time and errors, since it is easy to match up parts which have similar code letters.

The measuring and stamping action of this Model No. 144 B-83 gage is entirely automatic, but the parts are fed to and removed from the gage by hand. Gages with fully automatic feeding and sorting units are also available.

Circle Item 109 on postcard, page 219

Heavy-Duty Grinder

The Standard Electrical Tool Co., Cincinnati, Ohio, has announced a "GRIND Air-rester" of improved design. This 12- or 14-inch heavy-duty grinder has a self-contained dust-collecting unit built according to the Safety Code. The dust-control system is located inside the grinder base to conserve floor space.

A motor-driven material-handling fan operates simultaneously with the grinder motor. Dust and grit from the dust-collecting chamber fall into a drawer which facilitates their disposal. The steel wool filter pads are renewable and can be readily replaced.

The Type 2GAR 2-H.P. motor drives two 12- by 2-inch wheels, while the 3GAR 3-H.P. motor is used for 14- by 2 1/2-inch wheels. The grinding wheels are protected by adjustable safety guards. Each guard has a 4-inch exhaust outlet, hinged door, spark breaker and work-rest. Tool tray with removable water pot is located at front of pedestal. Plain or illuminated eye shields are optional equipment.

Circle Item 110 on postcard, page 219

Variable-Speed Snagging Grinders

The Foundry Grinder Division of the Standard Electrical Tool Co., Cincinnati, Ohio, has brought out a new line of variable-speed snagging grinders. These machines have a safety interlock feature that insures positive maintenance of a surface speed of 9000 feet per minute for the grinding wheel regardless of its diameter. This permits a small-diameter wheel or one that is nearly worn out to be operated at the same surface speed as a large wheel.

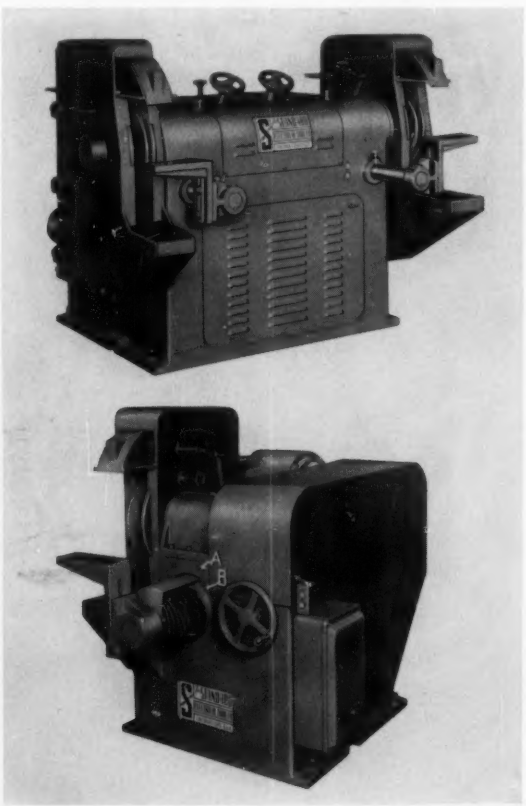
Speed changing is accomplished while the machine is running by merely turning a handwheel. A large wheel cannot be mounted on the machine spindle until the speed has been properly lowered.

The grinding wheels of the twin-motor double-end grinder, shown in the upper view of the accompanying illustration, operate independently, each wheel running at the correct surface speed irrespective of its diameter. One wheel may be stationary while the other is operating. This machine is available with 7 1/2- and 10-H.P. motors and wheels 24 to 30 inches in diameter.

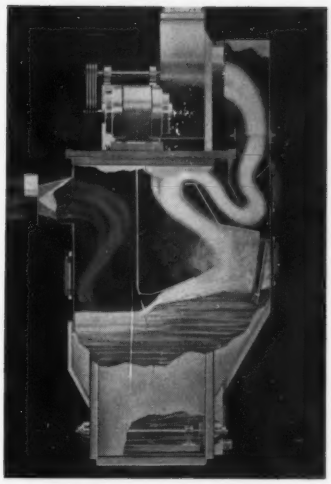
The single-wheel snagging grinder shown in the lower view is available in various sizes for wheels 20, 24, or 30 inches in diameter and with motors ranging from 5 to 50 H.P.

Circle Item 111 on postcard, page 219

"GRIND Air-rester" heavy-duty grinder with self-contained dust-collecting unit



Twin-motor double-end and single-wheel snagging grinding machines



Pangborn dust collector

"Ventrijet" Dust Collector

A wet type dust collector called the "Ventrijet" is being manufactured by the Pangborn Corporation, Hagerstown, Md., for use in metalworking shops, chemical plants, and foundries. This collector is said to achieve the proper mixing of atomized water with the air stream to permit efficient dust transfer without using mechanical means.

Dust-laden air enters the "Ventrijet" collector and expands in the inlet chamber at reduced velocity. The heavier particles sink to the bottom of the tank as sludge. The air is drawn through one or more venturi tubes into the discharge chamber. The low-pressure area in the venturi throat induces water also to enter the high-velocity air stream.

The mixing of air and water causes the transfer of dust particles from the air to the water particles. The air, water, and sludge mixture impinges at high velocity on special surfaces in the discharge chamber. The sludge settles to the tank bottom. The washed air then flows through an eliminator section for removal of droplets, and clean air is discharged. This dust collector is available in capacities of from 1000 to 30,000 cubic feet per minute.

Circle Item 112 on postcard, page 219

Sciaky Air-Operated Seam Welder

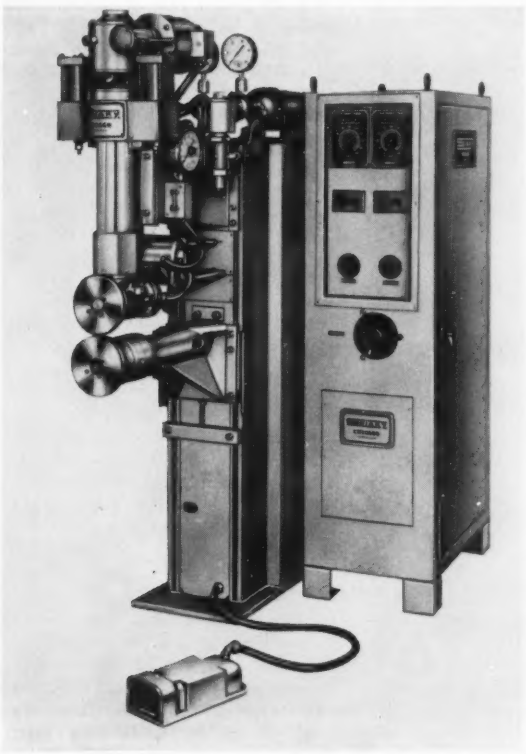
An air-operated press type MP 1 single-phase seam welder is announced by Sciaky Bros., Inc., Chicago, Ill. This welder is one of a series of sizes ranging from Nos. 1 through 5. It is available in 50- and 75-K.V.A. ratings at 50 per cent duty cycle. Throat depths range through 24, 30, 36, 42, and 48 inches. Maximum electrode force of 1000 pounds at an air-operating pressure of 80 pounds per square inch is available.

The MP 1 machine will weld a wide range of mild and stainless steel at efficient production wheel speeds. Although moderately priced, this welding machine is fully automatic, can be easily set up for production work, and is suitable for a wide range of welding applications.

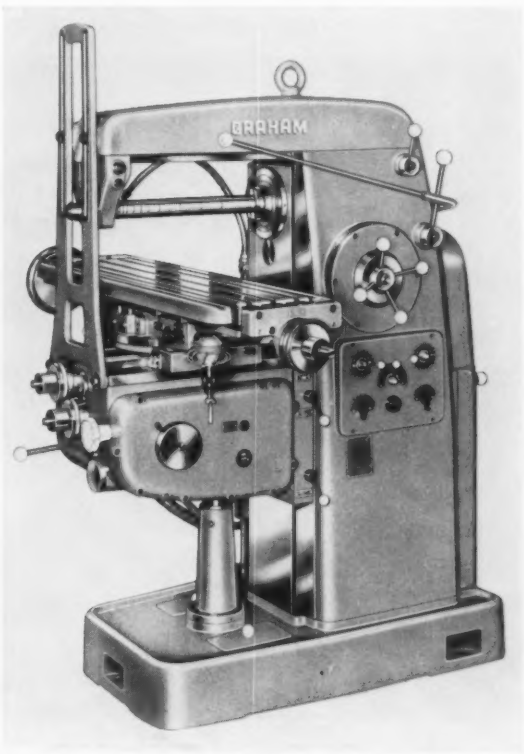
Circle Item 113 on postcard, page 219

Dial Type Universal Milling Machine

The Graham Machine Tool Co., New York City, has announced the addition of a new model to its line of dial type universal milling machines. This No. 2RL milling machine features the same dial type speed and feed selectors found in the larger No. 2R and No. 4R machines of this series. Power rapid traverse, forward and reverse, is provided in all three directions.



Air-operated seam welder made by Sciaky Bros., Inc.

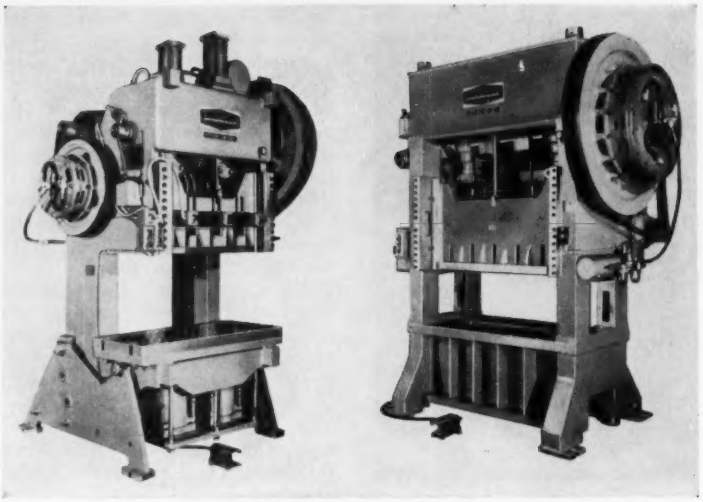


Graham dial type universal milling machine

The spindle is mounted in precision tapered roller bearings. A wide range of spindle speeds from 52 to 1500 R.P.M. assures correct and efficient cutting speeds for all materials. Separate geared speed and feed drives are provided for simple setups.

All moving parts, including hardened and ground gears, operate in an oil bath. The table lead-screw runs in its own oil reservoir, assuring minimum wear and prolonged accuracy. A fully universal dividing head and a heavy-duty vertical attachment and arbor are included with the standard equipment. A wide range of optional accessories is available, including automatic backlash eliminator, slotting heads, and universal vertical head.

Circle Item 114 on postcard, page 219



Presses brought out by the Johnson Machine & Press Corporation

Docker Shipping and Loading Truck

A 3000-pound, 48-inch Docker truck for use on shipping and loading docks was announced recently by the Automatic Transportation Co., Chicago, Ill. This is the heaviest of the Docker line and is operated from a standing position. It can be used in 7 1/2-foot aisles and will lift a capacity load 128 inches. The truck is 93 3/8 inches long and 38 inches wide. The drive tires are 16 1/4 by 7 inches. Total weight of the truck with battery is 5900 pounds.

Travel speed at 24 volts is 4.5 to 5 miles per hour, depending on load, while the lift speed is 30 to 55 feet per minute. Forks are adjustable from 7 to 32 inches. The mast assembly tilts 10 degrees backward or 3 degrees forward.

Circle Item 115 on postcard, page 219

Truck for use on shipping and loading docks announced by the Automatic Transportation Co.

Double-Crank Presses with Box Type Rams

Two new lines of double-crank presses, both featuring machines with box type rams, large bed areas, steel construction, low-inertia clutches, and electrical controls, have been announced by the Johnson Machine & Press Corporation, Elkhart, Ind. The 52 Series line of straight-side presses includes machines of 30-, 40-, 60-, 80-, 100-, and 150-ton capacities. The 80-ton machine is shown at the left of the accompanying illustration. These are high-speed blanking flywheel type presses with variable-speed drives operating at speeds up to 300 strokes per minute, or back-geared presses for drawing, forming, punching, piercing, or similar jobs.

The second line of presses is known as the G-2 Series. These are offered in 60-, 80-, 100-, and 125-ton capacities. The 60-ton model of this series, shown at the right in the illustration, has a 56- by 22-inch bed, a bed opening 28 by 10 inches, and a ram face 40 by 22 inches. The speed of the back-shaft is 303 R.P.M. The geared model makes fifty strokes per minute, whereas the flywheel press operates at the rate of 100 strokes per minute.

Like the 52 Series, the G-2 Series has an air clutch; air-actuated spring-set brake; and air-actuated counterbalance. This model is drilled and tapped to accommodate an air cushion for the die. It is motorized and has a selector switch for single-stroke or continuous operation.

Circle Item 116 on postcard, page 219

Dial-Operated Control System Facilitates Drilling Accurately Positioned Holes

An electronic control system for drilling machines, which simplifies drilling of accurately positioned holes in panel boards, has been developed by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. This control system is designed to enable an operator to "dial" the "X" and "Y" coordinates of a desired hole location and then perform the drilling operation by merely pressing a button. The drilling time per hole is reduced substantially by this system as it eliminates the manual lay-out work, checking, center-punching, and hand drilling. The possibility of human error also is minimized.

This system was designed for a special machine built by the Farwell Metal Fabricating Co., St. Paul, Minn., and is being used to drill holes for mounting instruments and dials on master panel boards. The controls and instruments which are mounted on such panel boards require virtually unlimited combinations of mounting hole spacing and locations, plus a wide range of hole diameters. The panels range from small units, a few square feet in area, accommodating only a handful of control instruments, to full-size sheets 4 feet by 8 feet and even larger. The panel material is usually 1/8 inch steel, although 1/2 inch Masonite is used where great strength is not required.

The drilling machine is equipped with a traveling drill head and a movable table that permits the cutting tool to be easily positioned over the work-piece. Both the head and table can be moved or traversed through a range of 4 feet, so that any point in a 4-foot-square area can be readily machined. "Step" methods permit the handling of larger sheets.

The drill head is equipped with a multiple-spindle attachment that can simultaneously drill up to five holes of different diameters to an accuracy of 0.005 inch. A variable-speed motor provides proper spindle speeds for drills as small as 1/32 inch in diameter. Use of a belt reduction permits sawing or fly-cutting holes up to 6 inches in diameter.

The drill head and table are positioned by conventional servo-mechanisms, controlled by the dials on the console. Other controls provide for jogging and controlling spindle speeds, sequence of drilling operations, and the choice of constant feed or constant thrust drilling. Indicator lights show the position of the head and the table relative to the "called-for" position. They also give the operator a visual indication when the cutting head is in its proper location. The head and cross-rail assembly can be raised or lowered to accommodate panels of various heights and shapes.

Circle Item 117 on postcard, page 219

Wesson "Poweramic" Carbide Tool Grinder

The Wesson Co., Detroit, Mich., has announced an offhand single-point carbide tool grinder featuring an oscillating wheel. Designated "Poweramic," this grinder eliminates the need for manual lateral movement, and is said to produce fine micro finishes on all standard and special single-point tools including square nose, V-nose, straight turning, facing, and boring tools.

Outstanding features are the "Tru-Arc" oscillation of the grinding wheel and the free-wheeling counterbalanced work-table. These two features permit the grinder to be used by non-skilled operators and virtually eliminate operator fatigue. Lateral tool movement is not required, and only a slight pressure on the work-table is needed to feed the tool into the grinding wheel.

Dial and push-button controlled automatic drilling machine developed by Minneapolis-Honeywell

"Poweramic" carbide tool grinder with high-speed reversible spindle brought out by the Wesson Co.

The motor-spindle and grinding wheel assembly is supported on pivots, and the entire unit is oscillated mechanically by a crank mechanism at the rate of 150 strokes per minute. Since the entire grinding wheel face reciprocates across the carbide tip, the wheel face is maintained in a uniformly flat condition. The cross-hatched pattern generated on the carbide tool is the result of the "arcing" movement of the rotating wheel as it moves laterally across the tool. Since the oscillating wheel provides all required reciprocation across the carbide tip, the tool (being ground) remains in a fixed position in the protractor work-holder. The work-table is supported on a trunnion-mounted table base, and travels to and from the grinding wheel on concealed ball bearings that roll on hardened ways, one on each end of the table base.

True angular settings of the table, ranging from 7 degrees above to 20 degrees below horizontal, are obtained by a crank mechanism. Settings are registered on a large, visible protractor on the side of the machine base. Coolant is supplied through a self-contained pumping unit in the base of the machine.

The spindle is driven by a reversible, 220-volt, 60-cycle, 1-H.P. motor with a spindle speed of 3450 R.P.M. The 1/6-H.P. motor of the crank mechanism operates on 220-volt, 60-cycle current at 1130 R.P.M. A 1/30-H.P. motor drives the coolant pump. Over-all dimensions of the grinder are 28 by 28 by 48 inches, and the weight is 615 pounds.

Circle Item 118 on postcard, page 219

"Economatic" Equipped to Process Two Types of Work

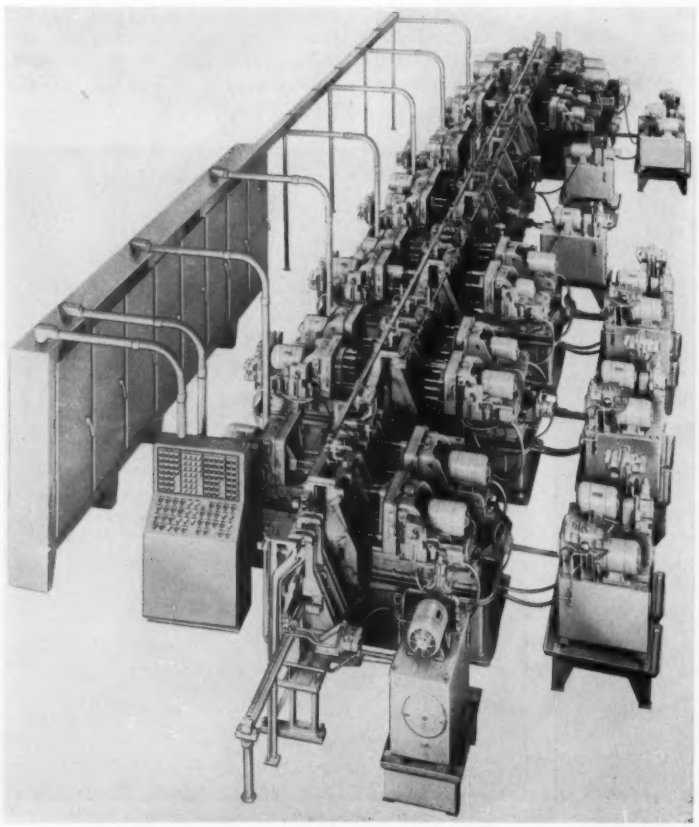
A twenty-two-station Buhr "Economatic," 70 feet in length, which performs 155 operations on two types of torque converter adapter plates at a production rate of 200 pieces per hour, has been announced by the Buhr Machine Tool Co., Ann Arbor, Mich. No selection or separation of the two different parts is necessary at the loading station of this machine since each machining station is equipped with an automatic part-selector.

Special features include: automatic lubrication of all moving parts; mist lubrication of spindles; automatic depth inspection of all holes before tapping; spindles arranged for pre-setting of cutting tools; and bases that are sectionalized to simplify processing changes.

Operations include drilling, reaming, boring, countersinking, inspecting, and tapping. Each machining station is equipped to use coolant from a central system. Chips pass through center of machine to conveyor in floor.

All standard and special machine parts are completely interchangeable; tapping spindles are of the individual lead-screw type with precision-ground and hard chromium-plated threads; and the multiple heads have shaved gears and broached and splined drives. Construction is according to J.I.C. hydraulic and electrical standards. The hardened and ground steel ways are automatically lubricated.

Circle Item 119 on postcard, page 219



Buhr "Economatic" equipped to process torque converter parts

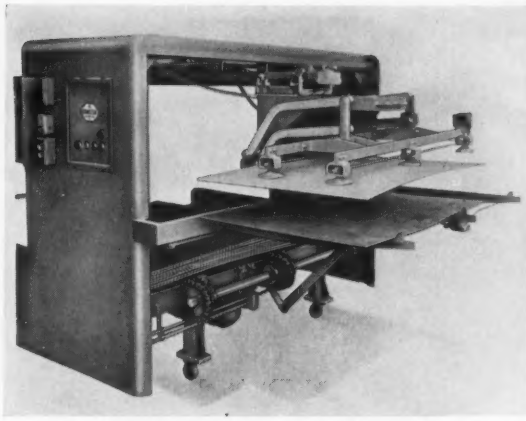
Bond Abrasive Segments for Grinding Metals

The Carborundum Company, Niagara Falls, N. Y., has made available for immediate delivery the newly developed V-40 bond segments for grinding all ferrous and non-ferrous metals. These segments, made of the highest grade of aluminum oxide abrasive grain and with the same special bond developed for Carborundum's V-40 tool-room grinding wheels, are now made in the variety of shapes used in all standard chucks.

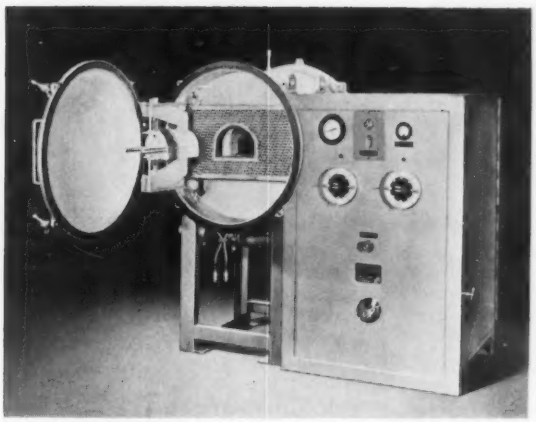
The segments have been specially designed for generating flat surfaces on plates, castings, and machine parts, and for grinding machine knives. They have exceptionally cool cutting action, long life, and size-holding ability. Uniform structure is an outstanding characteristic of the segment. Quality control from raw material to finished segments serves to insure exact duplication in repeat runs.

A new type of waterproof pad, applied to the segment with a special resilient cement, assures better holding power in the chuck. An additional feature is the recess in the end of the segment where the specification sticker is placed for easy reference to size, grit, grade, bond, and other information.

Circle Item 120 on postcard, page 219



Hamilton sheet feeder for punch press automation system



Harper high-temperature vacuum furnace for small production

Sheet Feeder for Presses

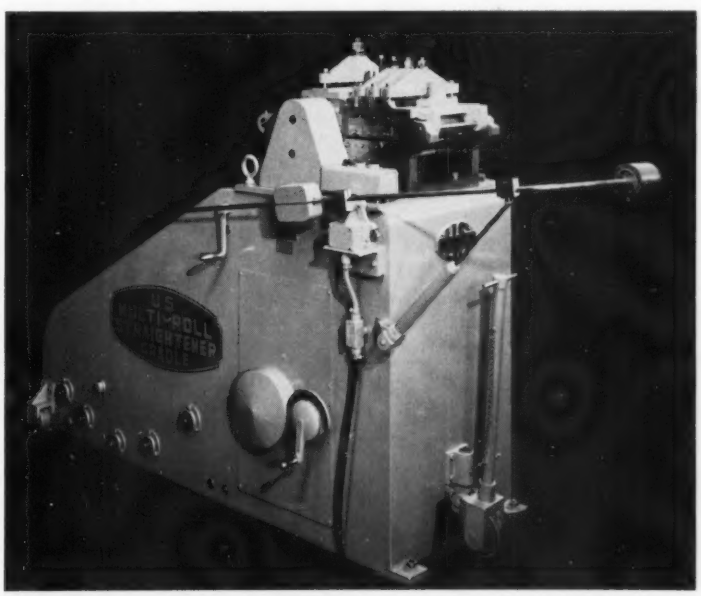
Hamilton Automation, Inc., Hamilton, Ohio, has added a sheet feeder to its line of automatic equipment for feeding, pulling, and positioning parts on die presses used for heavy metal-stamping operations. The sheet feeder is a standard basic unit which feeds a single sheet of steel to a punch press. This fully automatic feeder is air-operated, has 110-volt electrical controls, and is capable of handling up to thirty steel sheets a minute, depending upon the size of the blank. It will take work in sizes ranging from a blank 8 inches in diameter up to a sheet 48 by 144 inches. The feeder is self-contained and completely portable. Controls can be interlocked with those of the presses for complete automation.

Circle Item 121 on postcard, page 219

High-Temperature Vacuum Furnace

A high-temperature vacuum furnace, designed primarily as a research or small production furnace for heating metallic and ceramic parts in a vacuum of 200 to 300 microns at temperatures up to 2500 degrees F., has been announced by the Harper Electric Furnace Corporation, Buffalo, N. Y. The furnace shown has a D-shaped muffle with a chamber 7 1/2 inches wide, 13 inches deep, and 5 inches high. Heat is produced by resistance-heating elements, which are placed around the muffle. This electric vacuum furnace is available in larger sizes and with modifications for lower and higher temperatures.

Circle Item 122 on postcard, page 219



Coil cradle and power-driven straightener brought out by the U. S. Tool Company, Inc.

Combination Coil Cradle and Straightener

The U. S. Tool Company, Inc., Ampere, N. J., has brought out a combination coil cradle and power-driven straightener designated Model PDSC-940. This equipment will handle material up to 9 inches wide and 0.025 to 1/8 inch thick in coils up to 40 inches in diameter and weighing up to 1500 pounds.

The entire unit is mounted on casters for portability. The cradle has five coil rest rolls mounted in self-aligning bearings. The inner side frames are crank-adjustable.

The straightener is equipped with six hardened and ground straightening rolls mounted in needle bearings, the three lower rolls being power-driven. There is also a pair of hardened and ground, power-driven take-in rolls.

All upper straightening rolls are individually adjustable. The straightener is of hinged construction to facilitate cleaning of rolls and the starting of a new coil. Indicators on the straightening rolls simplify their setting. Equipment includes a mercury switch, loop-control mechanism and a 2-H.P., variable-speed drive that provides output feeds of 49 to 197 feet per minute.

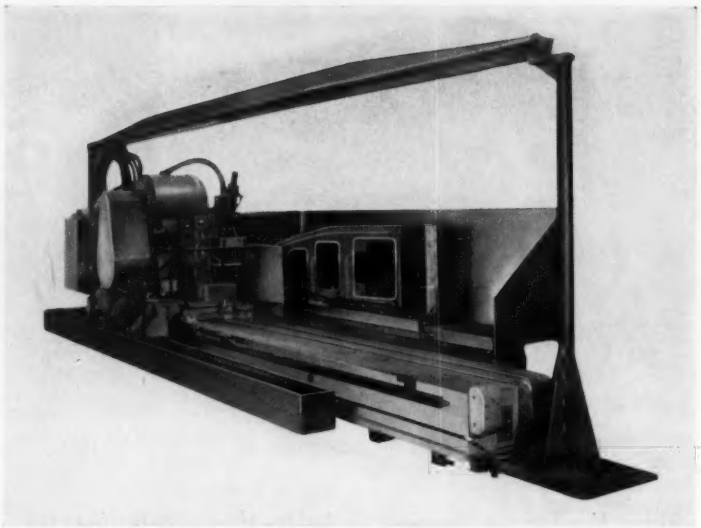
Circle Item 123 on postcard, page 219

Heavy-Duty Face Grinders with Traveling Wheel

Mattison Machine Works, Rockford, Ill., has recently redesigned its Series UK traveling-wheel face grinders, providing these heavy-duty production machines with more power and heavier carriages. The machines have been developed for precision grinding of long or bulky work-pieces that are extremely difficult to handle economically on any other type of equipment.

In operation, the work is clamped in a stationary position, and the grinding wheel is passed over the surface to be ground. The stationary table permits the use of fixtures and clamps as heavy as the work demands. Work of almost any length can be ground, because one end is supported by the machine table and the other by supplemental blocking.

Carriage ways have been made one-third longer and wider in the redesigned machines. Although a heavier carriage is used, the new ways are designed to reduce the pounds per square inch loading. The carriage is now driven by a variable-volume piston type hydraulic pump, in conjunction with a vane type fluid motor. Complete control of all machine functions is governed by a servomechanism. Adjusting the rate of speed, starting, stopping, inching, and positioning for unloading are all functions controlled by push-buttons from the operator's seat on the traveling-wheel carriage. The carriage speed has been increased to a range of 10 to 100 feet per minute. The power for driving the grinding wheel has also been increased throughout the line of UK machines.



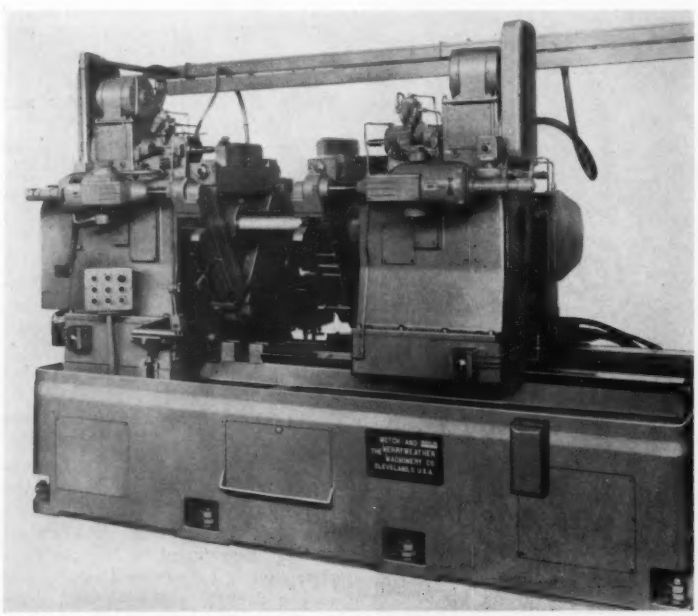
Mattison redesigned traveling-wheel face grinder

Circle Item 124 on postcard, page 219

Machine for Milling and Center-Drilling

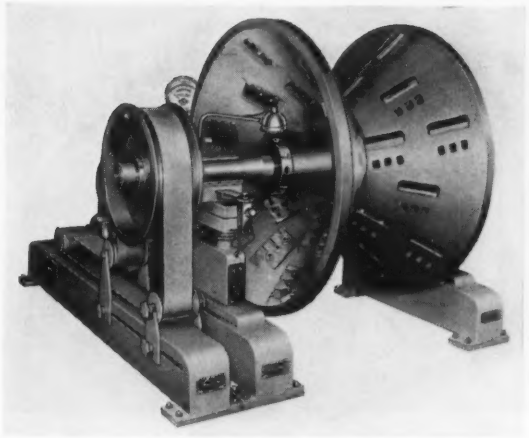
A trunnion type three-station machine for production milling and center-drilling work-pieces that are to be handled on tracer-controlled and automatic lathes has been announced by the Motch & Merryweather Machinery Co., Machinery Manufacturing Division, Cleveland, Ohio. This machine can be set up quickly to take work-pieces up to 48 inches in length. Both ends of the work-piece can be milled and drilled to a depth of 4 inches. Work length and the distance between center-drilled holes are maintained within the accuracy limits required for the precision type of work handled on automatic lathes and similar machines. The machine is arranged for complete automatic cycle operation, parts being manually loaded into the work-carrying fixture at the front of the machine, then progressively indexed to the milling and drilling stations, and back to the front of the machine for unloading. Automatic loading and unloading units can be incorporated in order to obtain complete automation of the milling and centering operations.

The work-carrying vises and the housing supporting the units on the right-hand side of the machine are adjustable. This housing is supported on broad ways and is power adjusted by means of a hydraulic cylinder. Manual clamps secure the housing to the ways in order to insure rigidity.

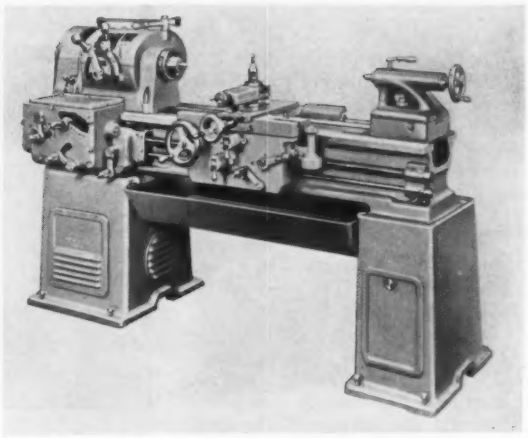


Motch & Merryweather machine designed for milling and center-drilling work to be finished on tracer-controlled and automatic lathes.

Circle Item 125 on postcard, page 219



Balancing machine made by Raydyne Corporation



Carroll-Jamieson geared-head engine lathe

"Mogul" Balancing Machine

The Raydyne Corporation, Springfield, Ill., has announced a "Mogul" balancing machine with units that can be positioned to suit the length of the piece to be balanced. Thus, the shortest rotor or the longest type of paper mill roll can be balanced. The drive unit may be positioned at either end or in the center of the machine. When not in use, the pedestal units can be pushed together to save floor space.

This balancing machine employs a true seismic free-in-space unbalance indicator attached to work-supporting mountings for locating and measuring small, as well as large, unbalance conditions. The mountings have chrome balls and raceways and provide over 4 inches of free amplitude travel. In addition to handling tremendous weight loads, this machine can be used in combination with variable-speed power drives for correcting large amounts of unbalance and is so designed that it can be employed at low, safe speeds.

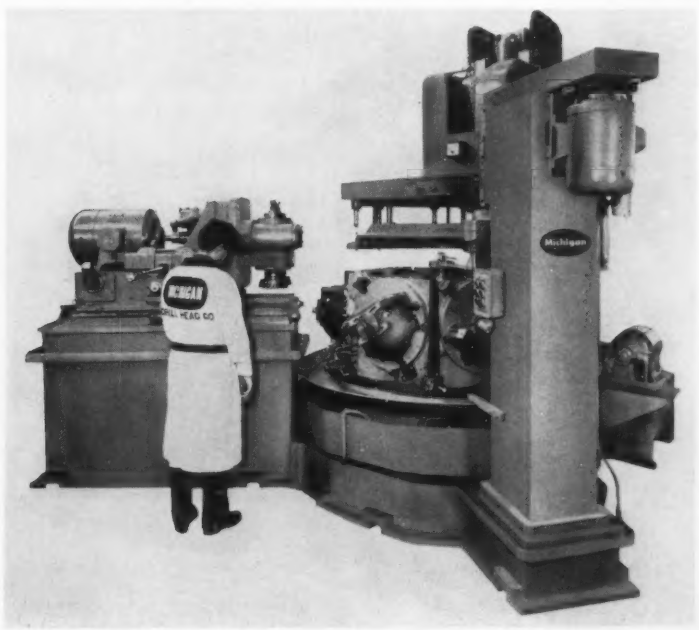
Circle Item 126 on postcard, page 219

Geared-Head Engine Lathe

A 16-inch, medium-duty, geared-head engine lathe has just been placed on the market by the Carroll-Jamieson Machine Tool Co., Batavia, Ohio. This Model GH lathe has twelve spindle speeds which are under immediate control of a clutch and brake. Separate drives are provided for feeding and thread-cutting. An improved gear-box furnishes forty-eight feeds through the feed-rod. The lead-screw, also driven from the gear-box, can be used to cut forty-eight threads ranging from 3 to 184 threads per inch.

Large, graduated dials are provided for the cross-feed and compound rest. Positive type clutches, actuated by separate levers, control the longitudinal and cross feeds. The carriage is 23 3/8 inches long. This lathe can also be furnished to swing 18 inches and with bed lengths up to 14 feet.

Circle Item 127 on postcard, page 219



Special machine for processing large transmission housings built by the Michigan Drill Head Co.

Special Three-Way Milling, Drilling, and Tapping Machine

The Michigan Drill Head Co., Detroit, Mich., has brought out a special three-way, horizontal and vertical milling, drilling, and tapping machine for handling large parts. This giant-size machine is tooled to handle 70-pound transmission housings for trucks at a production rate of fifty housings per hour.

The heavy-duty construction of this machine is said to solve the material-handling problem that normally accompanies the processing of large parts, as well as to insure long life for the machine. It is built to

J.I.C. electrical and hydraulic standards throughout. Because of the finishing operations performed on this machine, the number of times each heavy part must be handled is greatly reduced. A three-position indexing fixture is mounted on the six-station automatic index-table of the standard Michigan drill head. This fixture positions the part so that all machining operations are performed in either a vertical or a horizontal position. The fixture is equipped for power clamping.

The machine lends itself to simple retooling for model changes, standard components being utilized throughout. For example, a standard horizontal way type, self-contained, hydraulic feed unit is employed for milling; a standard vertical way type hydraulic feed unit is used for drilling and reaming; and a standard quill type master lead-screw unit performs tapping operations on the housing.

Both way type units are equipped with hardened and ground ways that are lubricated automatically; the milling head is equipped with antifriction bearings; and the drilling and tapping heads are of ball bearing construction, with all gears and spindles of heat-treated alloy steels.

Circle Item 128 on postcard, page 219

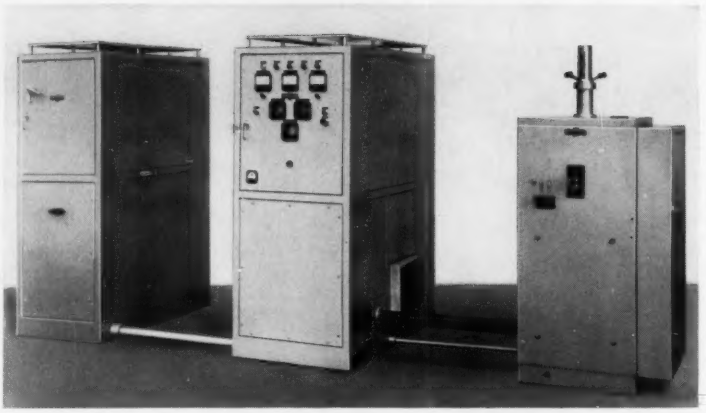


Fig. 1. Cincinnati induction hardening machine with power supply unit shown at left, and fixtures with tooling mounted on work unit illustrated at right

Cincinnati Induction Hardening Machine

A line of high-frequency induction hardening machines has been developed by the Process Machinery Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio. One of these machines, tooled up to harden hollow thin-walled turbine shafts, was exhibited at the recent ASTE Show in Chicago.

The new machines consist of three primary units: the power supply, oscillator, and work unit. Work and oscillator units can be placed directly in a production line, and, if desired, the power supply unit can be located at a distance of several hundred feet in an area of low-cost floor space.

An important feature of the new machine, rated at 30 K.W., is its

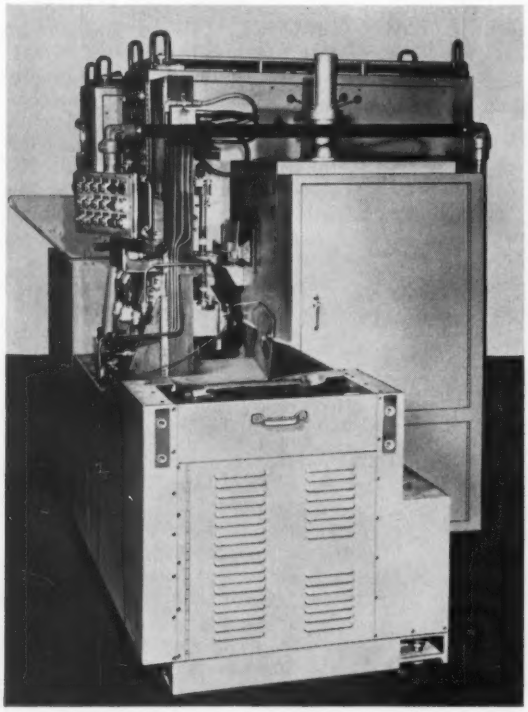


Fig. 2. Work unit with tooling for hardening hollow thin-walled turbine shafts

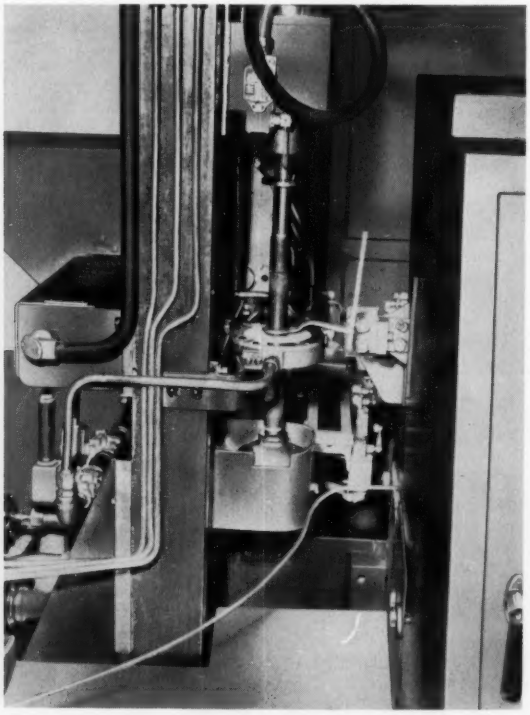


Fig. 3. Close-up of fixture showing work (hollow thin-walled turbine shaft) in position

high-frequency range of 1200 to 1400 kilocycles. This permits rapid surface hardening of parts requiring shallow case depth and very narrow transition zones between case and core, as well as small or thin-walled parts. Solid parts such as shafts up to 2 inches in diameter can be hardened, while the capacity for non-solid parts depends on their shape. It is also well suited to small-lot production operations.

The use of higher than average frequencies is said to result in faster operation, prevention of scale, reduction of distortion to an absolute minimum, and complete elimination of most straightening operations. An automatic work-handling system and automatic controls for high-production runs are available. The work unit is so designed that tooling can be easily changed.

Operator safety is assured by a low-voltage potential at the work coil, eliminating the possibility of shock. Positive interlocks on all units prevent servicing of the units while the power is on.

Circle Item 129 on postcard, page 219

Accessories for Kodak Contour Projector

Three new accessories for the Kodak contour projector Model 8 have been developed by the Eastman Kodak Co., Rochester, N. Y. One—a special glass measuring stage, for use in vertical projection, permits making linear measurements on the projector over a range of 2 inches by 1 inch. This new stage is available with micrometers calibrated either to 0.001 or 0.0001 inch.

Two—a rotary screen for measuring angles, replacing the standard ground-glass screen and used in either the horizontal or vertical projection position. A vernier scale permits direct readings to 5 seconds of arc.

Three—an overlay chart holder for use in horizontal projection, shown mounted on the Model 8 projector in the accompanying illustration. This holder permits the use of existing plastic or ground-glass charts of varying sizes. These accessories make the Model 8 a versatile 8-inch screen projector for optical gaging. It can be used for both linear and angular measurements, as well as for both horizontal or vertical projection. It can be quickly and easily transported on a special lightweight mobile base which accommodates the instrument in either vertical or horizontal projection position.

Circle Item 130 on postcard, page 219

Wet or Dry Grinder for Single-Point Tools

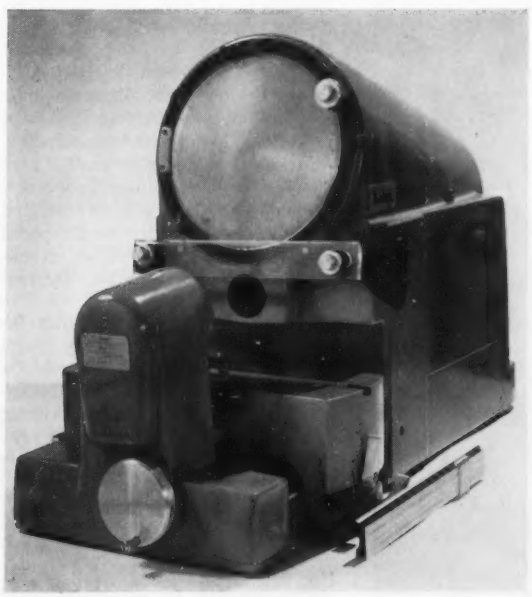
A double-end tool grinder, equipped for either wet or dry face grinding of large, single-point tools, is being introduced by the Ex-Cell-O Corporation, Detroit, Mich. This grinder, designated Style 48-B, can be used for roughing out tool shanks of all sizes. With suitable wheels, the machine will recondition high-speed steel, cast alloy, and carbide tools for a wide variety of work.

Two 10-inch, plate-mounted wheels are used. The wheel shaft rotates in heavy-duty, double-row ball bearings, permanently lubricated and sealed against entry of dirt and abrasive particles. The spindle is driven by a V-belt from a reversible motor located in the base of the grinder. Ample tool-rest tables are adjustable to the predetermined tool-sharpening angles.

Heavy sheet metal guards are attached to the table brackets and move with them—there are also conventional guards. A pressure coolant system having its own tank and pump is provided. Coolant delivered at each wheel is controlled by an individual valve. Splash guards prevent waste of coolant when the grinder is operating.

An accurate protractor tool guide, a universal adapter for grinding the top rake of tools, a diamond wheel dresser, and tool-holders for both round and square tools are available as extra equipment for use with this machine.

Circle Item 131 on postcard, page 219



Kodak Model 8 contour projector shown in horizontal position with accessory overlay chart holder

Ex-Cell-O double-end wet or dry tool grinder designed for grinding large single-point tools

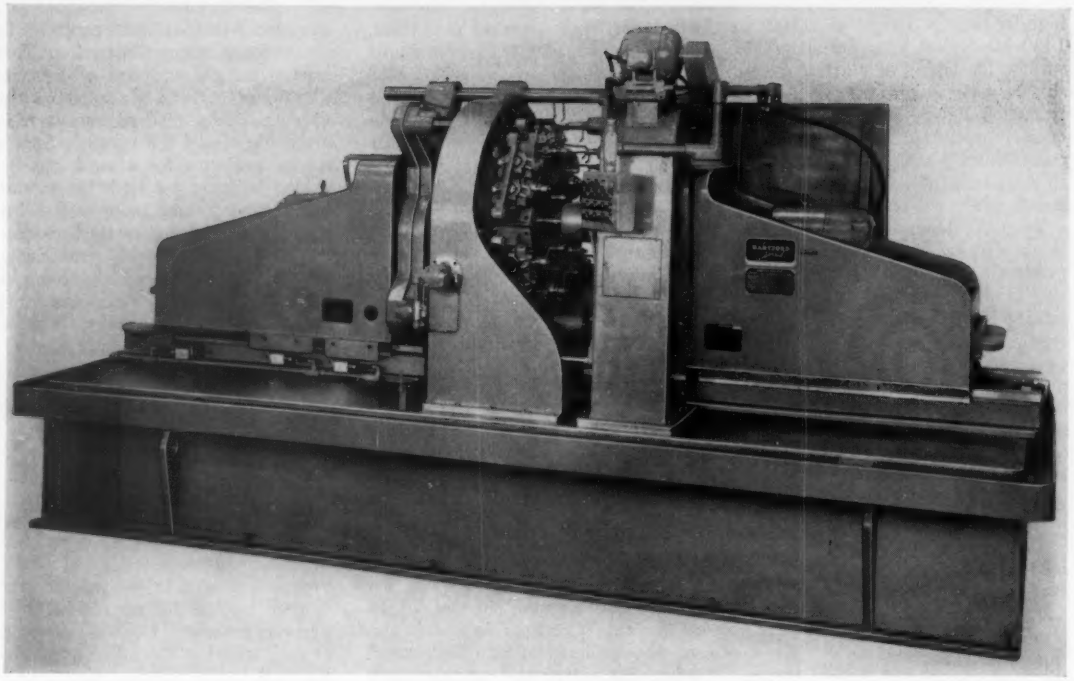


Fig. 1. Hartford special machine for drilling and tapping differential bearing caps

Indexing Type, High-Production Drilling and Milling Machines

An indexing type drilling and tapping machine for processing cast-iron differential bearing caps is a new product of the Machine Tool Division of Hartford Special Machinery Co., Hartford, Conn. This machine, Fig. 1, is designed to drill, ream, tap, chamfer, and spot-face bearing caps at the rate of 480 pieces per hour. The parts are placed in a dual loading fixture with an equalizing manual clamp on a six-station, vertical, trunnion style dial. Two hydraulic feed units with multiple-spindle heads and one lead-screw tapping spindle perform the operations.

The twelve-station, horizontal indexing drilling and milling machine, Fig. 2, has been built to drill, tap, slot, straddle-mill, and broach nine different brass throttle shafts. Five cam-fed drill units, one lead-screw tapping unit, and one air-operated broach are used to process the parts. Four drill units with milling attachments are mounted horizontally, and one, vertically.

The lead-screw tapping unit for this job is mounted vertically. Parts are loaded in a V-block with a hand-screw clamp and automatically indexed through the processing cycle. Production at 100 per cent efficiency is at the rate of 600 parts per hour.

Circle Item 132 on postcard, page 219

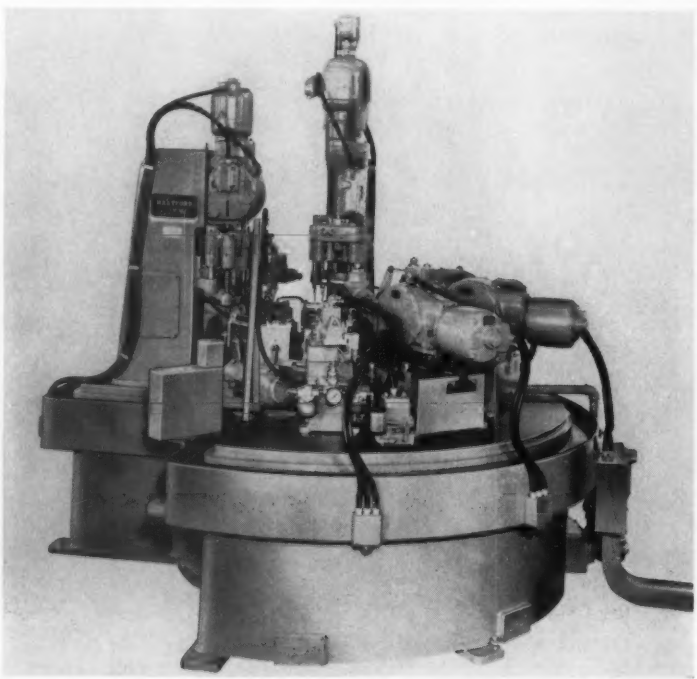
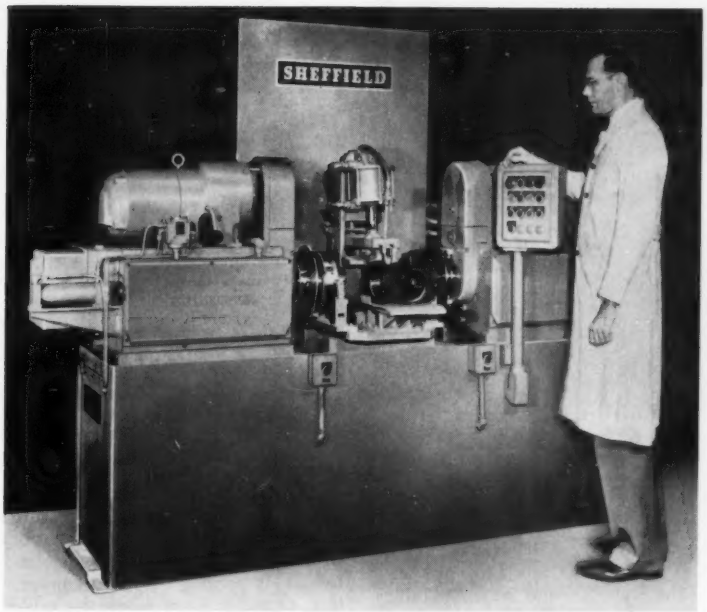


Fig. 2. Machine for processing nine different throttle shafts built by Machine Tool Division, Hartford Special Machinery Co.



Sheffield double-end machine equipped to process gate valve bodies

Double-End Boring, Chamfering, Facing, and Threading Machine

A double-end machine that bores, chamfers, faces, and threads both ends of gate valve bodies in pipe sizes ranging from 2 to 6 inches at the rate of sixty parts per hour, including loading and unloading, is being manufactured by the Sheffield Corporation, Dayton, Ohio. The machine consists essentially of two Model 300 "Precision-Pak" threading and boring units and an air-operated work positioner and clamping device mounted on a common base. The "Precision-Pak" is an individually powered automatic threading unit having a precision lead-screw and hydraulic feed for boring and facing. It is powered by a 5-H.P. motor and has a gear type, four-speed drive.

The valve body to be machined is hand-loaded into the work-holding device and automatically clamped in place by an air cylinder. Clamping action initiates the two-cycle machining operation. First, two Sheffield Murchey receding pipe taps equipped with carbide taper reamers, facing and chamfering tools advance automatically, removing approximately 1/8 inch of stock from the bore of the part, 1/16 inch of stock by a facing cut, and machining a 1/8-inch 45-degree chamfer. A slow-down valve in the hydraulic feed unit causes the tools to move in very slowly during the facing cut.

After the full depth of stroke is reached, the tools retract automatically; the chasers are automatically "cocked" or expanded to the cutting position; and the precision lead-screw advances the taps, assuring accurate thread leads and precise alignment of the threads at opposite ends of the valve body. Upon reaching full thread depth, the chasers collapse; the taps are quickly returned; the part automatically unclamped; and the cycle stopped. The machine is approximately 8 feet long, 3 feet wide, and 5 feet high.

Circle Item 133 on postcard, page 219

Single-Crank Straight-Side Presses

A line of single-crank, straight-side presses is being built by the Niagara Machine & Tool Works, Buffalo, N. Y., to supplement its double-crank types. The new presses are of streamline construction, which conceals the driving mechanism. There is no overhanging equipment at the rear of the press or over the operator's head to obstruct crane service, block light, throw grease, or take up floor space.

The all-steel, rigidly constructed one-piece frames of triple box section design—which provide maximum resistance to deflection from horizontal, diagonal, and torsional stresses—are said to assure greater accuracy and longer die life. Box type welded steel slides are power-adjusted through self-locking barrel type connections to accommodate a wide range of die heights and to permit quicker, easier, and safer die setting. Ample shut height and long slide adjustment permit the use of a wide range of stamping and forming dies. Electro-pneumatic clutch control is provided to insure safe, easy, and efficient press operation.

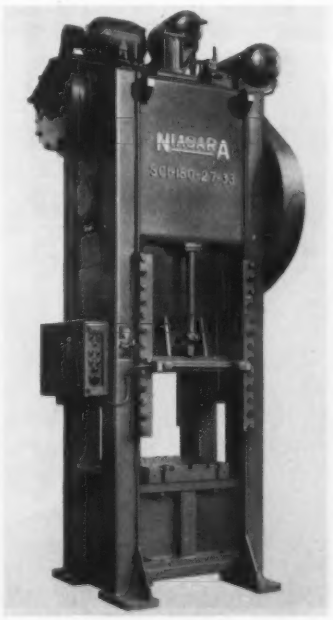
These presses are available in capacities of 100 to 400 tons. Optional equipment includes automatic lubrication system, pneumatic die cushions, automatic feeds, variable-speed drives, knock-out bars, and other features to meet individualized needs.

Circle Item 134 on postcard, page 219

Thor Right-Angle Drive for Impact Wrenches

A right-angle attachment, No. 568, for air- and electric-driven impact wrenches has been announced by the Thor Power Tool Co., Aurora, Ill. This drive is designed for original equipment manufacturers, as well as for general use in shops and factories where wrenches must be employed in comparatively inaccessible places. The attachment fits any 1/2-inch, square-drive impact wrench.

The spindle can be offset 29/32 inch to the front, right or left, to



Niagara single-crank press

permit operation in close quarters. The compact unit is less than 6 inches long, has a head height of 2 3/8 inches, and weighs 2 1/2 pounds.

The attachment consists of a heavy aluminum housing, alignment bushings, and locking pins. Spindles are made of tool steel, and all gears, of an alloy steel. Oil-sealed antifriction bearings are employed to insure maximum power delivery.

Circle Item 135 on postcard, page 219

High-Speed Precision Lathe with Push-Button Control

Spindle speeds can be changed instantly by simple push-button control on the Hardinge DV59 high-speed precision lathe recently introduced by Hardinge Brothers, Inc., Elmira, N. Y. The infinitely variable speed control incorporated in this lathe is said to make possible the production of more parts of higher quality at lower cost. This lathe is especially designed for tool and instrument makers, laboratory machinists, lathe operators, and others who must determine the correct spindle speeds for each particular operation as the work progresses. Instant and variable changes in spindle speed can be made by pressing either the "faster" button or the "slower" button until the desired speed is reached. The variable-speed drive provides a range of 230 to 3500 R.P.M.

The power-operated speed changes are actuated from a control box located over the headstock. The speed indicator shows the exact speed at all times. A ball-bearing, lever-operated collet closer assures fast, easy, and positive collet gripping. This collet closer, furnished as standard equipment, saves valuable production time because the operator can open or close a collet or step chuck while the machine is in operation. Collet tension is immediately adjustable throughout the full range of light to heavy holding power without the use of tools. The lathe is fitted with a 5C collet having a capacity of 1 1/16 inches.

Circle Item 136 on postcard, page 219

Hamilton "Portelvator" Elevating Tables

Extensive changes and additions have been made to the line of "Portelvator" portable elevating tables manufactured by the Hamilton Tool Co., Hamilton, Ohio. Lift capacities of the Style "O" and Style "A" tables have been increased from 1000 to 1500 pounds and from 2000 to 2500 pounds, respectively, and designations have been changed to "Portelvator 15" and "Portelvator 25." Other units of the line include "Portelvators" 35, 50, and 50-6.

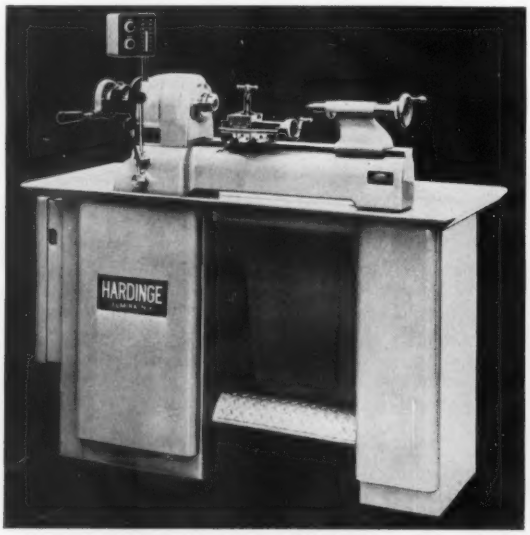
The 35 and 50-6 models are new additions to the line. These two tables, which have lift capacities of 3500 and 5000 pounds, are "six-wheel" models; have two 12-inch roller bearing wheels occupying center positions; and one 6-inch roller bearing caster under each of the four points of support. It is said that this wheel arrangement reduces the manual effort required to push a loaded table, and facilitates turning in cramped places. Another feature of these tables is the arrangement of the lift mechanism for side operation. This permits easy and convenient operation even when the table is loaded with long, overhanging sheets. A "small-tool tray" welded to the top surface of the bottom plate provides an added convenience for hand-tools.

"Portelvator" elevating table made by the Hamilton Tool Co.

Circle Item 137 on postcard, page 219

Instrument for Measuring Surface Roughness

A portable instrument for measuring surface roughness, called the "Surfindicator," is being manufactured by the Brush Electronics Co., a Division of Clevite Corporation, Cleveland, Ohio. This instrument



Hardinge high-speed precision lathe

(Below) Brush "Surfindicator" checks micro-finish on shafts. This portable instrument is adapted for checking surface finish at the machine.

weighs only fifteen pounds, is ruggedly constructed for shop use, and can be employed by shop personnel after only a few minutes instruction. It can be calibrated to read surface roughness directly in either arithmetic average or r.m.s. values. The measuring range is from 1 to 1000 micro-inches.

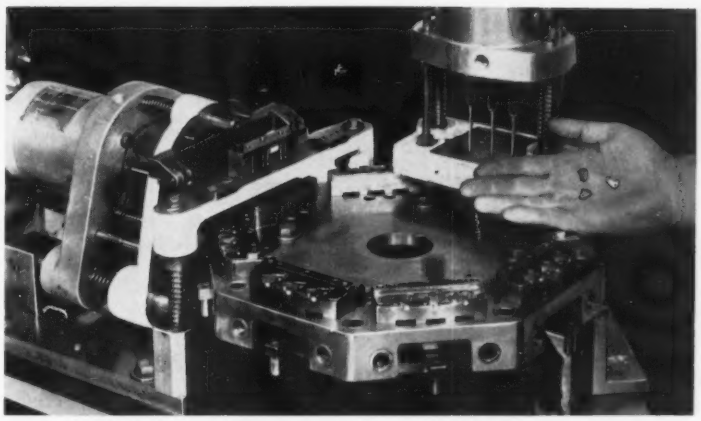
The Surfindicator can be used to measure surface roughness of metal, plastics, glass, vitreous ware, ceramics, paper, and other materials. It is especially designed for checking finish right at the machine. This practice eliminates rejection of parts due to coarse finish and, equally important from the economic standpoint, it reduces excessive finishing beyond the point necessary for proper functioning of the part.

Circle Item 138 on postcard, page 219

Rotary Indexing Table for Drilling Small Parts

A special eight-station rotary indexing table made by Zagar Tool, Inc., Cleveland, Ohio, facilitates use of standard drilling and reaming heads in the rapid production of a detent for a Navy fuse that is roughly the size of a fingernail. Two gearless multiple-spindle drill heads are used—one vertically mounted to ream two holes, and one horizontally mounted to drill a hole in the side of the detent.

Three work-pieces are held in each station and drilled simultaneously. Two holes which pass through the part are spaced on 5/16-inch centers and are 1/16 and 3/32 inch in diameter. The side hole, 0.052 inch in diameter, is drilled through a 1/16-inch section from another station. Six stations are always open for loading, cleaning, and unloading. The parts are loaded manually. Progressive indexing and ejection are performed automatically. Production is at the rate of 1200 pieces per hour.

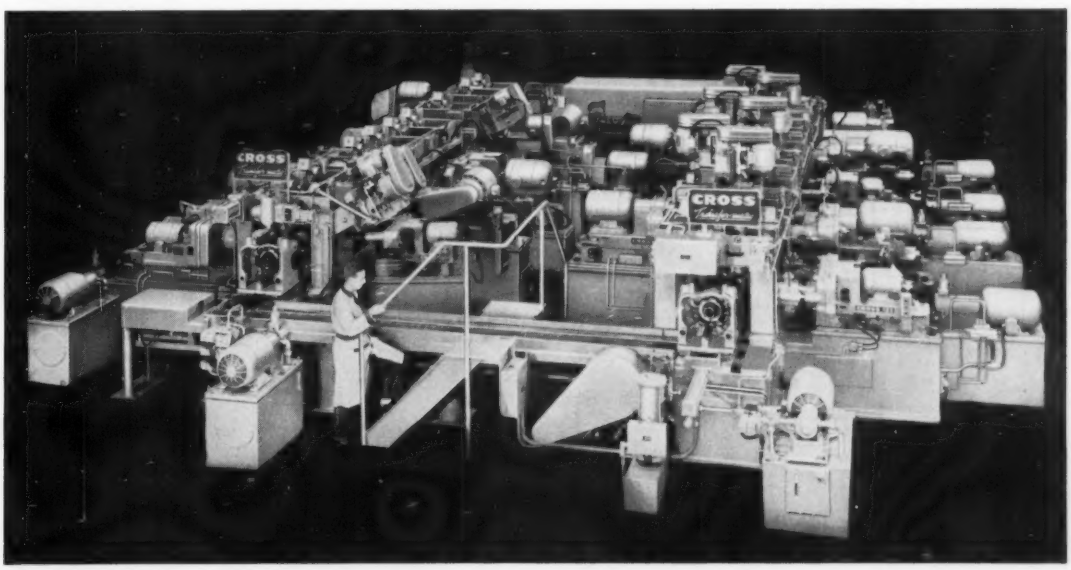


Equipment for rapid drilling of small parts made by Zagar Tool, Inc.

Circle Item 139 on postcard, page 219

"Transfer-Matic" for Processing Differential Gear Carriers

A multiple-station "Transfer-matic" machine, designed to process differential gear carriers at the rate of 115 pieces per hour, has been announced by The Cross Company, Detroit, Mich. In operation, the machine rough- and semifinish-bores the pinion axial and crosswise holes; rough- and finish-faces and turns the pilot diameter of the torque tube flange; mills the faces of the cross-bore bosses; spot-faces the flange mounting holes; and drills, chamfers, reams, and taps all other holes except the flange holes. In all, seventy-three operations are performed, including milling, boring, cross-facing, turning, drilling, spot-facing, chamfering, reaming, tapping, and probing.



Cross "Transfer-matic" equipped for processing differential gear carriers

Parts are clamped and unclamped on the pallet-equipped work-holding fixtures by means of hydraulically operated torque wrenches. A washing and drying unit for cleaning the fixtures is installed between the last cutting station and the loading station. Easy maintenance is assured by complete interchangeability of all standard and special parts. Other features of the machine, which has been constructed in accordance with J.I.C. standards, are: automatic lubrication; hardened and ground ways; and hydraulic feeds.

Circle Item 140 on postcard, page 219

Automatic Machine for Drilling Condenser Tube Sheets

A high-speed, automatic machine for drilling precision holes in condenser tube sheets is available from Walter P. Hill, Inc., Detroit, Mich. This electrically operated, hydraulically controlled machine combines speed of a two-way drilling machine of maximum flexibility with accuracy of a horizontal boring machine. A multiplicity of holes on precision-controlled, closely spaced centers with selected drilling patterns can be produced by the new machine. It will drill tube sheets of ferrous and non-ferrous materials up to 6 feet in diameter and 10 inches thick, such as used on heat exchangers, condensers, evaporators, and heaters. Thinner sheets and baffles can be drilled in stacks up to 10 inches thick.

Feeds up to 18 inches per minute can be used in drilling steel tube sheets with 3/4-inch oil-flute drills. Load meters for each of the two drilling head motor drives indicate condition of drill sharpness and any hard spots that may be encountered in the material. They can be set to automatically retract the drill under either instantaneous or continuous overload conditions. A high-pressure coolant system is provided to permit gun-drilling operations.

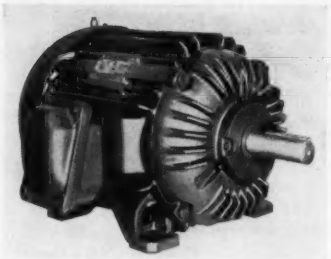
Heads are powered with 10- or 15-H.P. motors. A 5-H.P. motor drives the hydraulic pump that provides pressure for the table travel and head feed hydraulic cylinders. A pump delivering 5 gallons per minute, driven by a 3-H.P. motor, provides high pressure for the head coolant systems. The heads have four speeds and variable hydraulic feeds. Over-all dimensions of the machine are: height, 12 feet; length, 16 feet; and width, 11 feet.

Circle Item 141 on postcard, page 219

Allis-Chalmers "Synduction" Motor

An alternating-current synchronous induction motor—called "Synduction"—designed for general industrial use has been announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. This motor, developed at the firm's Norwood Works, is available in ratings from 1/4 to 40 H.P. It is built on standard induction motor frames and enclosures and uses a simple die-cast rotor. The motor requires no brushes, slip rings or windings on the rotor, separate source of direct-current excitation, or special starting equipment.

The motor is said to approach the efficiency and power factor of squirrel-cage units. It starts as an induction motor with a very high locked-rotor torque, accelerates and pulls into synchronism quickly, and runs as a synchronous motor. Having a high (175 to 200 per cent) pull-out torque, the motor remains synchronized regardless of load or line voltage fluctuations. It operates over a wide frequency and, therefore, a wide speed range. Frequencies of 300 cycles and speeds above 10,000 R.P.M. are available. Motors for frequencies as low as 10 cycles have been developed.

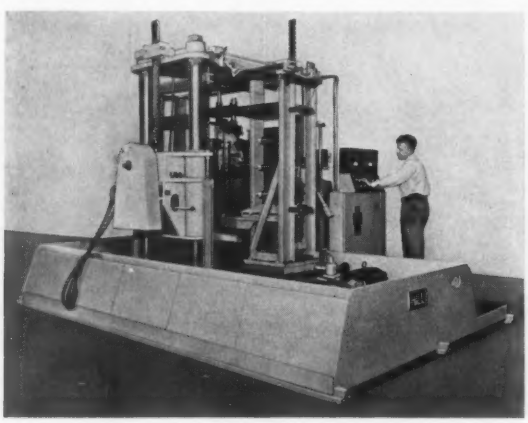


Totally enclosed "Synduction" motor made by Allis-Chalmers Mfg. Co.

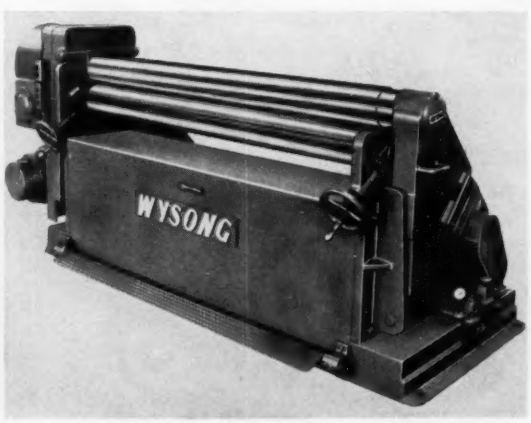
Circle Item 142 on postcard, page 219

All-Steel Bending Rolls

Wysong & Miles Co., Greensboro, N. C., has introduced a series of 6-inch all-steel power bending rolls. The rolls, known as the "D" series, are made in lengths of 48, 60, 72, and 120 inches. They have been brought out as companion machines to the company's 4 1/2- and 5-inch power bending rolls and are of the initial or pinch type. Standard features include parallel adjustment of the rear or forming roll by a handwheel at the front of the machine; and a safety treadle that extends across the front of the machine. Stepping on the safety treadle stops the machine.



Hill automatic tube-sheet drilling machine



Wysong all-steel power bending roll

A single lever releases the drop-end, which, when lowered, raises the upper roll. All three rolls are power driven by a 7 1/2-H.P. motor with push-button control and reversing magnetic starter. The worm-gear drive runs in a bath of oil. Rolls are accurately machined from alloy steel and are grooved to suit the buyer's specifications.

Optional equipment includes an air-operated drop-end with an air vitalizer unit; power adjustment for the rear roll, operated by a 3/4-H.P. magnetic brake motor with push-button starter and forward and reverse control; a magnetic brake main-drive motor; and a cone rolling attachment.

Circle Item 143 on postcard, page 219

Milling Cutters with "Throw-Away" Carbide Inserts

The Wesson Co., Detroit, Mich., has introduced "throw-away" insert milling cutters designed to handle the majority of rough- and finish-milling work on cast iron and steel. The insert blades of these cutters never require sharpening. They permit high-speed milling at high feeds. Negative radial and axial rake combinations provide ample clearance and give eight cutting edges on square blades. Quick set-up and elimination of complicated blade adjustment make rapid blade indexing possible, resulting in reduced set-up time.

Since the cutters do not have to be resharpened, excess reserve inventory of cutter bodies is not required. Cutters, in some cases, can be maintained at the machine. Efficient milling of both cast iron and steel is possible with the same cutter body, using inserts of different carbide grades.

Uniform and positive blade location is achieved by placing a simple ring gage against the cutter face. Blades are then aligned by making contact with the gage and are locked in position by taking up on the socket-head clamping screw.

Circle Item 144 on postcard, page 219

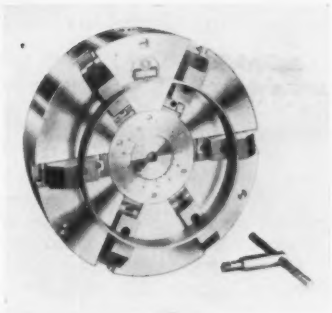
Lightweight Universal Chuck with Controlled Centering Pressure

Horton Chuck Division of E. Horton & Son Co., Windsor Locks, Conn., has introduced a lightweight six-jaw universal chuck with controlled centering pressure. This chuck is designed to operate rapidly and accurately and to center the work-piece without danger of distortion due to overtightening by the operator.

The holding pressure desired is obtained by making a simple setting on a calibrated plate in the center of the chuck. The six universal jaws are then advanced toward the work-piece simultaneously until contact is made and the pre-set pressure is reached. At this point, the jaws stop automatically, due to a slip-clutch arrangement, and hold the piece at the required pressure until released. This action eliminates the danger of distorting small-diameter thin-walled rings, weldments, and other fragile parts.

The chucks are manufactured in diameters of 12, 15, 18, 21, and 24 inches for any type of spindle mounting and are available in 3-, 4-, 6-, and 8-jaw styles. Top or work jaws can be supplied in any style to meet specific requirements.

Circle Item 145 on postcard, page 219



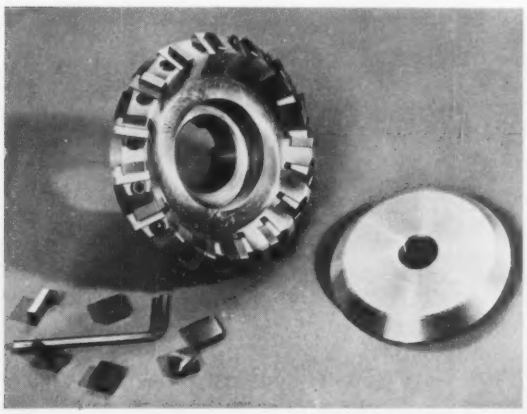
Horton lightweight universal chuck

Turntable for Tool Grinder

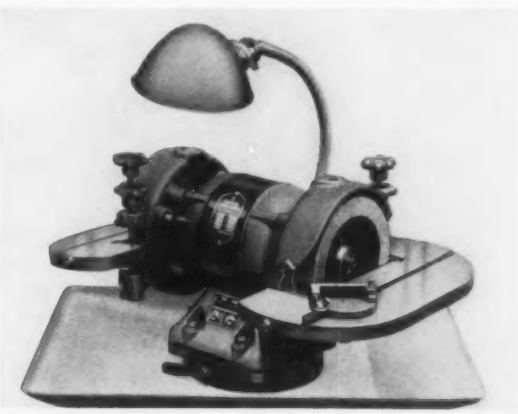
Thomas Prosser & Son, Tenafly, N. J., have announced a turntable base for their bench tool grinders. The turntable is provided with an ingenious quick-acting positive clamp that can be released to permit the grinder to be turned so that either end faces the operator. This arrangement facilitates instant changing from roughing to finishing without requiring the operator to move from one end of the machine to the other. It also permits mounting the grinder anywhere on a long bench, up against a wall, or at the most convenient point nearest the work.

The turntable base can be had with or without a drip pan. It will accommodate either the Prosser Model AA carbide grinder or the Model AP precision grinder.

Circle Item 146 on postcard, page 219



Wesson milling cutter with "throw-away" carbide blades and ring gage for setting blades



Tool-grinding machine equipped with turntable brought out by Thomas Prosser & Son

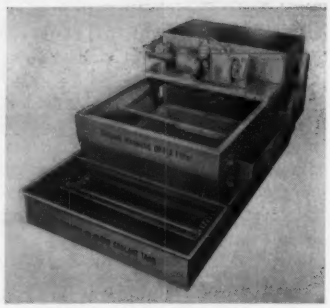
Red Ring Gear Checker

A Red Ring Model SIC-24-inch gear checker that inspects spur gears up to 25 1/2 inches in diameter for accuracy of tooth size, spacing, eccentricity, and parallelism is available from the National Broach & Machine Co., Detroit, Mich. Spur gears and splined parts up to 11 3/8 inches between centers can be checked.

Gears to be checked are mounted between centers on head- and tailstock units. Interchangeable heads are provided for checking eccentricity, size, and tooth-to-tooth spacing. Parallelism accuracy of each side of a spur gear or spline tooth is checked by a double indicator head mounted in a precision ball-bearing slide unit in front of the part being checked. The base of the slide unit is locked in a slot in the surface plate which is at an angle of 90 degrees to the slot which locates the headstock and tailstock. This slide unit has a 9-inch handwheel-controlled travel that moves the indicator finger across the tooth face.

Eccentricity and size are checked by an indicator unit at the rear of the part being checked. Tooth-to-tooth spacing is measured by a tooth-spacing head. The gear checker occupies a floor space about 60 by 51 inches.

Circle Item 147 on postcard, page 219



Improved Delpark "Up-Flo" filter

"Up-Flo" Magnetic Separator and Filter

The Industrial Filtration Co., Lebanon, Ind., has redesigned its Delpark "Up-Flo" filter with permanent, bar stock bronze screen to include magnetic separation. This method makes use of a flat magnetic field on which the liquids are diffused. This principle of design employs the force of gravity to assist the magnetic field.

The "Up-Flo" action carries the liquids that have been exposed to the magnetic field up through the permanent 0.004-inch bar stock screen to remove particles such as abrasives which do not respond to the powerful No. 5 Alnico magnets. The liquid flows into a storage tank where settled particles smaller than 0.004 inch are removed by chain-driven flights.

The bar stock screen is cleaned by air shakers which shake embedded particles from the screen. This residue with the ferrous particles is removed by chain-driven flights.

Circle Item 148 on postcard, page 219

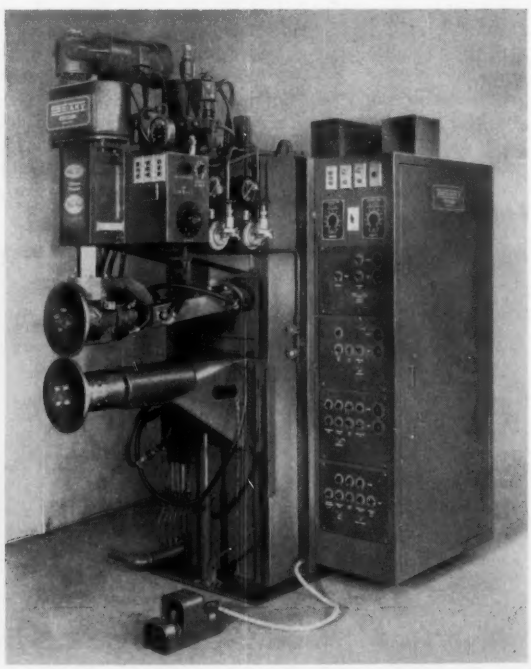
Resistance Welder with Precision Timing Control

A precise timing control for resistance welding, designed to satisfy the most rigid military and commercial welding specifications, has been developed by Sciaky Bros., Inc., Chicago, Ill. This control achieves a high degree of accuracy by counting cycles of the electric power line frequency.

It is intended for resistance welding involving many interrelated variables. For example, with a Sciaky standard press type, air-operated machine, a typical sequence consists of squeeze, weld, hold, and off periods.

The most important unit of this equipment is the Dekatron cold cathode type gas tube. This tube has ten cathodes with two guide pins between each pair of cathodes. When in operation, this tube applies a negative voltage to the cathode which is

Red Ring gear checker announced by the National Broach & Machine Co.



Sciaky resistance welder equipped with new precision timing control

Outstanding savings at the spindle! That's what the exclusive Extended Spindle Face assures you — on every Brown & Sharpe Universal and Plain Milling Machine. Here's how this unique design feature cuts milling costs:

SUPER SAVINGS AT THE SPINDLE!

with exclusive Extended Spindle Face design

First; it provides extra rigidity that permits use of shorter and smaller diameter arbors and smaller cutters — saves on tool cost. Second; use of smaller cutters permits faster feeds and shorter run-in for any surface finish — saves time. Third; shorter distance between spindle nose and cutter minimizes vibration — saves cutters. Fourth; convenient table location and extra work clearance save work motions — reduce operator fatigue. And these are only the savings at the spindle! In addition, Brown & Sharpe Milling Machines offer many other original design features such as independent motors for spindle, knee, and pump — features that step-up efficiency of your operations. For details, write Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Ask About Our Pay-as-You-Depreciate Machine Tool Plan

Saves money

Saves time

Saves cutters

Saves work motions

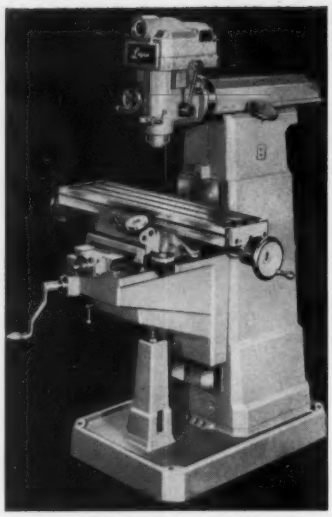
to be fired. When the counting operation is started, pulses are fed to the guide pins, and thus the flow is transferred from one cathode to the next until the count has been completed. This count may be any amount from one to ten, and any operation which will furnish a pulse may be used to actuate or "trigger" the tube. By adding a decade Dekatron, the count can be increased to 100. Adding a third Dekatron will increase the count to 1000.

Circle Item 149 on postcard, page 219

Vertical Milling Machine

The Logan Engineering Co., Chicago, Ill., has announced a vertical milling machine of improved design with speeds of from 80 to 570 R.P.M. in the low range and 584 to 3800 R.P.M. in the high range. A built-in tachometer indicates the exact spindle speed. Power feed for the spindle within the range of 0 to 0.008 inch is readily obtained. The simple positive control of the quill feed makes it easy to obtain holes of the correct depth when blind drilling. Simply moving the quill feed control lever to the neutral position, for example, stops the spindle feed, making it unnecessary to stop rotation of the spindle.

The ram slides on dovetailed ways that provide a rigid clamping surface 16 inches long, assuring freedom from vibration. The 1 1/2-H.P., 3-phase motor is located in the base of the milling machine. The ground working surface of the machine table is 36 by 9 inches. The table has a longitudinal movement of 18 inches, transverse movement of 10 inches, and vertical movement of 10 5/8 inches. The spindle nose is of the collet chuck type. The head rotates on a rigid sleeve mounting that maintains the exact right-angle alignment.



Logan vertical milling machine

Circle Item 150 on postcard, page 219

DoALL Black Granite Surface Plates

The DoALL Co., Des Plaines, Ill., is manufacturing granite surface plates and accessories to supplement its line of gage-blocks and gaging instruments. These products are made from "black" granite which, according to National Bureau of Standards tests, has unusual strength and density.

The plates range in size from small toolmakers' flats 8 by 12 inches to huge, one-piece lay-out tables 72 by 144 inches. Larger surfaces can be obtained by joining several granite tables with special stands. Accessories include black granite straightedges, parallels, and angle-plates.

The black granite has a Rockwell hardness of 80 C and shows very little deflection under load. Accuracy is maintained for an indefinite period even with abrupt changes in temperature. The smooth "frosted" finish of the plates is said to permit easy sliding of instruments over their surfaces yet prevents tools or instruments from "wringing" to the plates. The dark surface of the granite provides a good background for lay-out lines which can be scribed with a sharpened brass brazing rod.

Circle Item 151 on postcard, page 219

Slip Roll Forming Machine

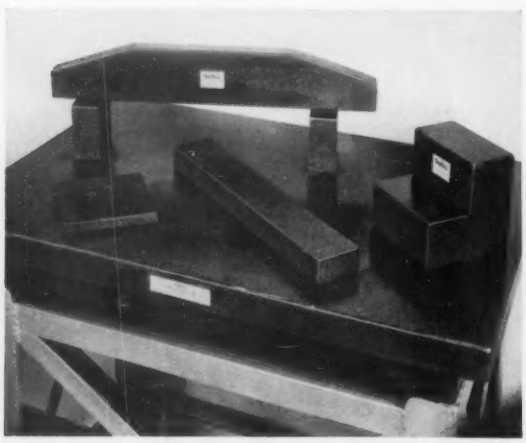
Niagara Machine & Tool Works, Buffalo, N. Y., has brought out a line of slip roll forming machines built in modified models with optional equipment for rapid forming of rectangular and similar shapes. Both power- and hand-operated machines can now be provided with this equipment which will alternately produce curved and flat surfaces. It is especially adapted for high production of round-cornered tanks, containers, and similar objects.

The rear roll of the 6-inch diameter machine is positioned pneumatically between two limits to alternately form curves and flats. On the smaller machines, the rear roll action is mechanical.

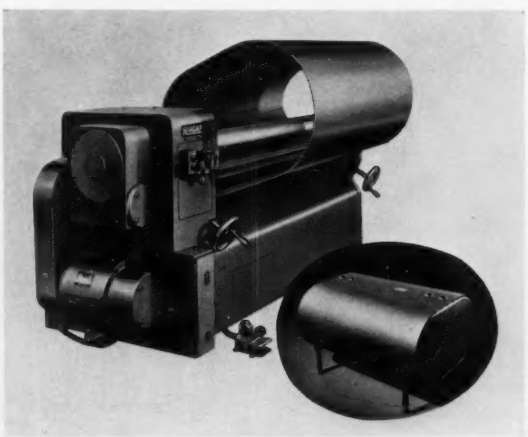
A simple lay-out on the sheet to be formed, with markings indicating where curves begin and end, is all that is required as a guide.

Circle Item 152 on postcard, page 219

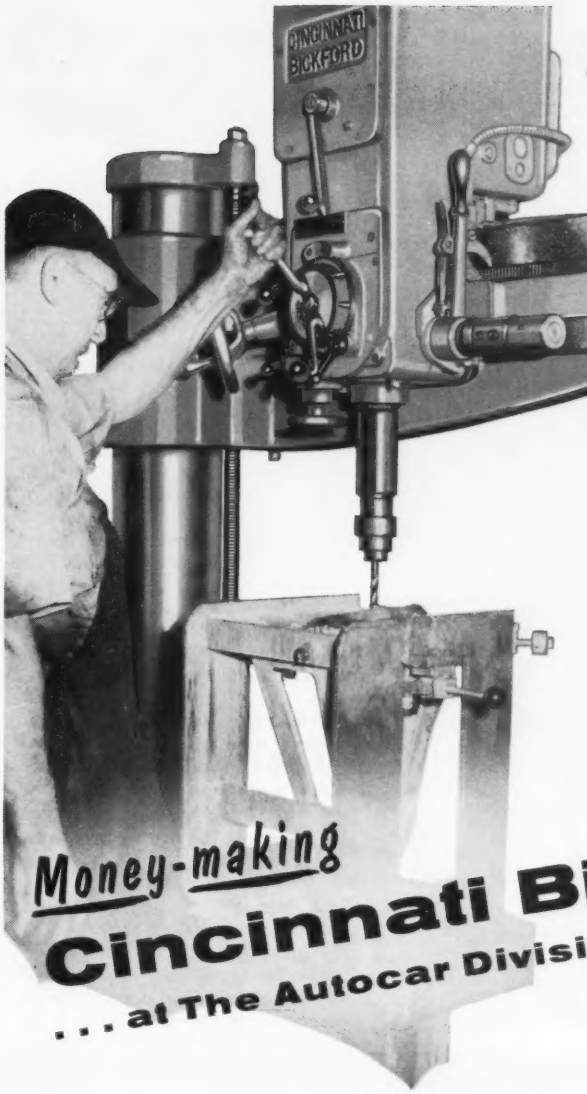
(*This section continued on page* 216)



DoALL black granite surface plate and accessories

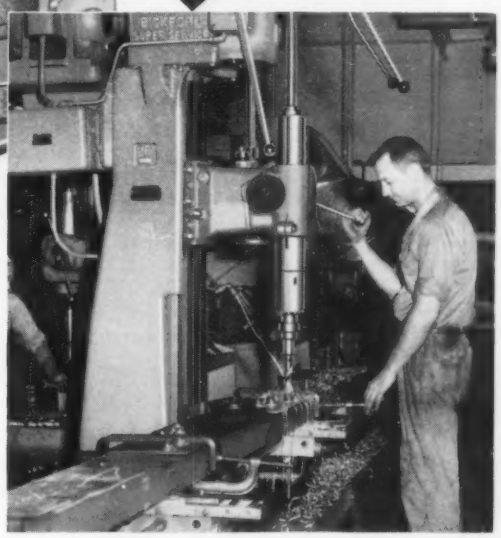


Niagara slip roll sheet metal forming machine



The 9" dia. column 3' arm Cincinnati Super Service Radial is working on chassis frame parts and aluminum steering column brackets; ¼" dia. to 1¼" holes drilled and reamed to a .0015" tolerance.

The Upright Drill shown is one of six 28" Super Service Uprights working on heat treated alloy steel frames.



Money-making Cincinnati Bickford machines ... at The Autocar Division, WHITE MOTOR CO. —EXTON, PA.

Photos courtesy the Autocar Division of The White Motor Company, Exton, Pennsylvania.

Speed and easy handling—power and accurate, steady performance were factors in the selection of Cincinnati Bickford Super Service Radial and Upright Drills in this plant. They are quickly adaptable to a variety of operations, including drilling, reaming, tapping and trepanning.

For rapid, accurate, dependable production investigate these cost reducing modern drilling machines.

Write for Bulletin R21C.

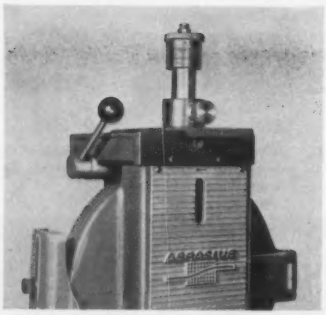
CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

Cincinnati 9, Ohio, U.S.A.

GIDDINGS & LEWIS MACHINE TOOL CO. : Fond Du Lac, Wisconsin.



Built-In Wheel Dresser

Built-in wheel dresser offered as optional equipment on all "Hydrabrasive" precision surface grinders manufactured by the Abrasive Machine Tool Co., East Providence, R. I. Engineered to rigidly fit into the grinder head, this wheel dresser features a micrometer adjustment that accurately measures and controls the amount the wheel is dressed. With this device, an operator can quickly dress the wheel without having to disturb the work or machine set-up.

Circle Item 153 on postcard, page 219

Stock-Oiling System for Press Operations

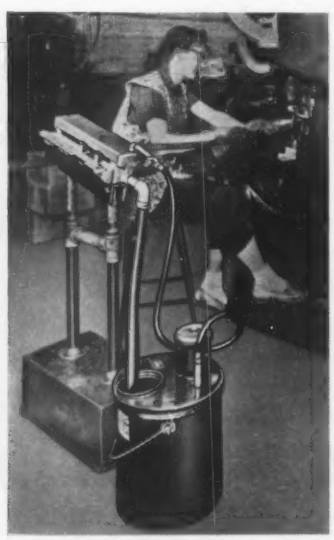
Stocklube system with five-gallon tank and one-gallon-per-minute pump added to line of equipment manufactured by Graymills Corporation, Chicago, Ill. This system is designed for long or short runs. The circulating pump discharges lubricant through a manifold to coat top and bottom of stock. Excess oil is rolled off and recirculated after screening. The five-gallon container is portable. The oil is confined within the housing, and the metal is not only lubricated but also cleaned, as loose dirt and rust are flushed off by a flood of oil. Horizontal guides are adjustable for stock up to 3/16 inch thick. The oil leveling rollers are of smooth steel. The new Models R6-4-25 and R12-4-25 are for light-bodied oils. A 1/4-H.P. unit is offered for heavy compounds. Stocklube heads are available in two sizes for maximum stock widths of 6 or 12 inches.

Circle Item 154 on postcard, page 219

Sterling Drill Grinder

A simple, accurate adjustment for grinding drills to any included angle from 90 to 140 degrees is a feature of this Model "DV" Sterling drill grinder recently announced by McDonough Mfg. Co., Eau Claire, Wis. Changing the included angle adjustment is accomplished accurately by tilting the grinding wheel head instead of adjusting the work-holding unit. The angle adjustment is made by a handwheel that actuates a rack and pinion. A positive lock in the handwheel holds the head at any angle. A built-in clearance gage accurately indicates the angle being ground on any size drill. This model will grind 2-, 3-, and 4-flute drills from 1/8 inch to 2 1/2 inches in diameter. Equipment includes built-in diamond wheel dresser. Power is furnished by a 1/2-H.P. motor.

Circle Item 155 on postcard, page 219



Thor Air Grinder

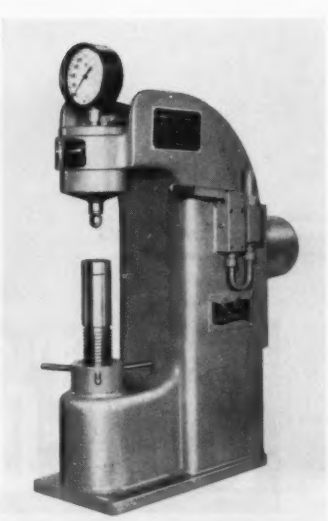
Powerful air grinder, designed especially for use in foundries and other metal-working plants, made by the Thor Power Tool Co., Aurora, Ill. This 7-pound Model 5V grinder replaces the company's Model 250-D air grinder. It is available in speeds of 4500, 6000, and 8000 R.P.M. equipped with adjustable, positive-speed governor designed to increase air economy and assure safe operation under all conditions. A built-in exhaust muffler effectively reduces noise levels. Extra equipment available includes: vertical cup grinder, sander, wire brush machine, and cut-off grinder accessories.

Circle Item 156 on postcard, page 219

Bench Type Brinell Hardness Tester

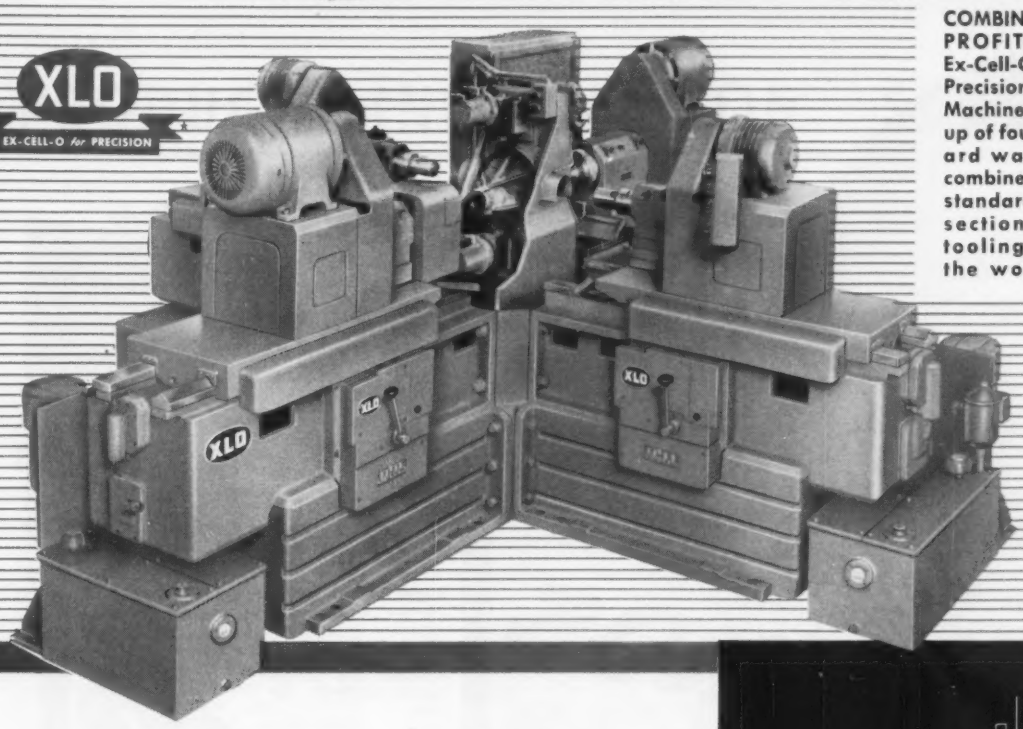
Motorized Brinell hardness tester, announced by Steel City Testing Machines, Inc., Detroit, Mich., said to combine operating economy with simple operation and dependable accuracy. This Model L tester is intended for both laboratory and shop

(*Continued on page 224*)



XLO

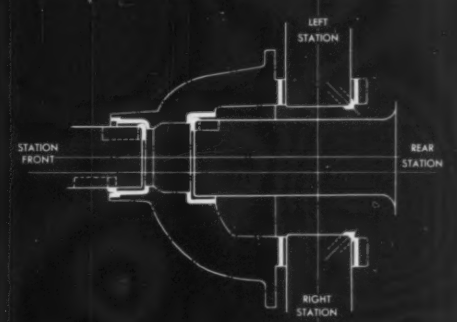
EX-CELL-O for PRECISION



COMBINED FOR PROFITS—this Ex-Cell-O 4-Way Precision Boring Machine is made up of four standard way units combined with a standard center section, with tooling to suit the work.

4 HOLES, 90° APART, BORED SIMULTANEOUSLY

BY EX-CELL-O 4-WAY MACHINE



SIMULTANEOUS MACHINING of four holes assures a 90° relationship between bearing bores and pinion bores.

This differential carrier assembly requires the boring of accurate holes at right angles to one another. Bore diameters are held as close as .0005". Shoulders must be square with bores. Bearing bores must be square with pinion bores.

Here was an opportunity to combine operations by using an Ex-Cell-O 4-Way Precision Boring Machine, with these profitable results:

FASTER PRODUCTION—machine works simultaneously from four directions.

PRECISION—accurate bores, holding the 90° relationship, are produced by precision spindles, smooth, hydraulically operated slides, and accurate location of the way units.

RELOCATION ERRORS ELIMINATED—since the part is located and clamped only once, there can be no errors caused by relocating and reclamping.

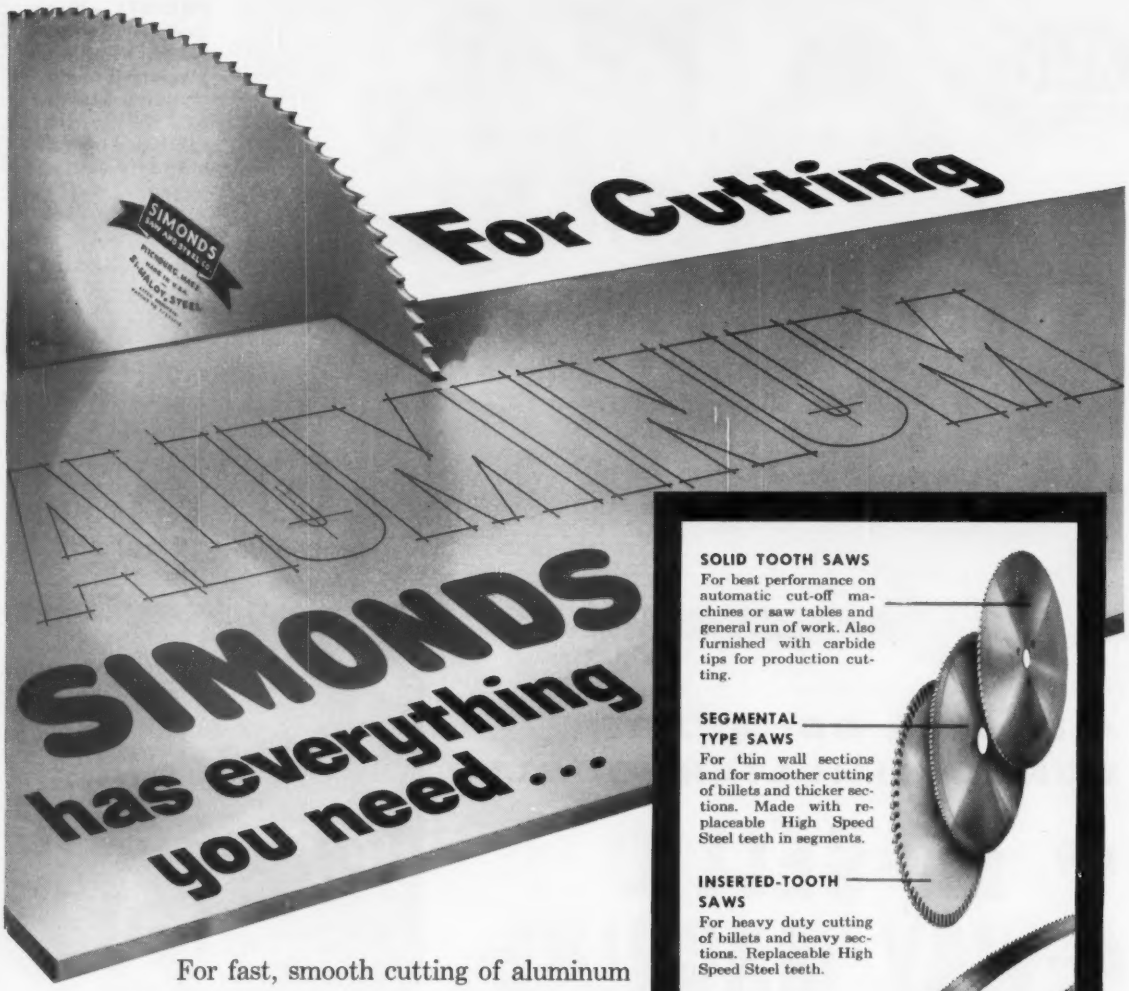
Is there an opportunity to cut costs and combine operations in your product? These way-type precision boring machines, special machines composed of standard units, also are used in automated production lines. They can be placed side by side and connected with transfer type fixtures to form transfer machines, or they can be combined in a transfer machine at those stations where precision boring and similar operations are required.

Ask your Ex-Cell-O Representative about all the other advantages of Ex-Cell-O Way Machines, or write for Bulletin.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



For fast, smooth cutting of aluminum flats, billets, rods, extrusions . . . or any other soft metals and materials . . . Simonds has the right saw or file for any particular job. Made of special job-rated Simonds steels . . . by top men working under ideal controlled conditions in Simonds famed windowless factory . . . every Simonds tool has the bonus-factor of finest performance and longest life. Yes, on any metal-cutting job, remember: "Say Simonds . . . *and save*".

SOLID TOOTH SAWS
For best performance on automatic cut-off machines or saw tables and general run of work. Also furnished with carbide tips for production cutting.

SEGMENTAL TYPE SAWS
For thin wall sections and for smoother cutting of billets and thicker sections. Made with replaceable High Speed Steel teeth in segments.

INSERTED-TOOTH SAWS
For heavy duty cutting of billets and heavy sections. Replaceable High Speed Steel teeth.

"SABRE TOOTH" BAND SAWS
New design saw features a special tooth *with a hook*, for freer, faster cutting.

"RED END" HACK SAW BLADES
3 types, for hand or power cutting, each available in standard sizes and tooth-spacings, enable you to choose the one best blade for each job.

"RED TANG" FILES FOR ALUMINUM
Choose from a complete line . . . American Pattern, Milled Curved-Tooth, Rotary and Swiss Pattern Files. First quality only.

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On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

PNEUMATIC SYMBOLS—Ross Operating Valve Co., 120 E. Golden Gate Road, Detroit, Mich. 40-page booklet listing all J.I.C. symbols for pneumatic valve controls, together with a drafting template guide in ready reference form. The simplified drawings in each category may be used to designate the pneumatic equipment of any manufacturer, and the drafting template guide which accompanies the booklet is an aid for the quick drafting of desired symbols. Further assistance is provided by the coding system included in the booklet which keys each of the symbols to each of the guide codes and to the Ross catalogue number. The booklet, together with the drafting template guide, can be obtained for $1 by writing directly to the above company.

ALUMINUM CASTING—Reynolds Metals Co., 2500 S. Third St., Louisville, Ky. 130-page technical handbook "Casting Aluminum," giving information on the design and production of aluminum castings. It contains clear and concise information on how to select a casting process and the aluminum alloy best suited. Data on typical mechanical properties is also presented. Explained are the various pig and ingot classifications, and the effect of the common alloying elements used with aluminum. Many different alloy classifications are discussed and their principal characteristics presented. One chapter is devoted to six of the main casting methods: sand casting, permanent mold casting, die casting, centrifugal casting, plaster mold casting, and precision investment casting. The important factors in each method are carefully explained. This textbook is ring-bound and can be obtained free of charge by writing on a company letterhead to the above address.

STAINLESS-STEEL WIRE—Webb Wire Division, Carpenter Steel Co., New Brunswick, N. J. Bulletin describing a variety of types of stainless-steel wire. It includes the analyses, tensile strength, physical properties, and gages of twelve types of stainless wire most generally used in the manufacture of wire products. Specifications for all of the wire types are given in easy to read chart form. Each of the wire grades covered is described in terms of distinctive characteristics and suggested use. The entire grouping is broken down into austenitic, martensitic, and ferritic classifications. 1

ROLLER BEARINGS—Chain Belt Co., Shafer Bearing Division, Downers Grove, Ill. 72-page catalogue on the company's self-aligning roller bearings. Contains specifications and data on all models of Shafer units. The various models have shaft sizes ranging from 3/4 inch to 7 inches. Described is the principle of concave rolls running between convex raceway, the Shafer micro-lock adjustment, and Shafer "7" Seal. Completely revised engineering data, new load rating tables, and exploded views for parts identification are included. 2

CONTROL AND TRANSFER SWITCHES—General Electric Co., Schenectady, N. Y. Bulletin GEA-4746B, covering the company's complete line of control and transfer switches for low-voltage applications up to 600 volts AC or DC. Publication includes photos, drawings, cutaways, and discussion of special features. Switches with watertight and explosion-proof housings are described. Bulletin also contains application data, representative contact diagrams, and ordering directions. 3

FORMING MACHINES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 77, describing the company's line of slip roll forming machines equipped for rapid forming of various shapes. Both power and hand-operated models are described. The bulletin also includes an explanation of the factors governing the selection and operation of slip roll formers and a full description of the company's standard line of slip roll forming machines for cylindrical work. 4

MEASURING EQUIPMENT — General Electric Co., Schenectady, N. Y. Booklet GEC-1016, entitled "Measuring Equipment," containing complete product information including applications, sources of additional information, and pictures. Ranging from simple thickness gages to the mass spectrometer leak detector, there are instruments for research, production, laboratories, and educational use. Measurement categories include color, leak detection, insulation, and radiation monitoring. 5

HIGH-STRENGTH BOLTS — Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. 20-page illustrated booklet giving practical working information on high-strength bolts. Sections of the booklet are devoted to identification of high-strength bolts and proper sizes, comparisons with machine bolts, use of hardened washers, and good installation practices. Included is data on proper tightening, calibration of impact wrenches, air supply, and inspection techniques. 6

POWER TOOLS—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. 8-page booklet entitled, "Make Up Your Own Mind About Using Power Tools Teamed With Machine Tools," illustrating and explaining the advantages of teaming standard industrial power tools with special-purpose machine tools. The booklet lists ten reasons why the strategic use of power tools in a supplementary capacity can increase production, improve product quality, and reduce costs. 7

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DRILLS—Chicago-Latrobe, Chicago, Ill. Folder giving information on high-speed utility drills designed and heat-treated for those applications requiring a sturdier, shorter drill than available in conventional fractional letter or wire drills. The drills with the shorter flute and over-all length have greater rigidity and withstand much of the stress and strain which would cause conventional length drills to fail. 8

DIRECT-CURRENT MOTORS—General Electric Co., Schenectady, N. Y. 12-page bulletin GEA-6355, illustrating and describing the Kinamatic direct-current motors built to new N.E.M.A. standards. Information is given on electrical and mechanical features, versatility of standard line, features for easier maintenance, plus dimensions and ratings. Also available is a 6-page bulletin GEA-6461, describing and illustrating Kinamatic generators 3/4 to 100 K.W. 9

INDUSTRIAL FILTERS—Industrial Filtration Co., Lebanon, Ind. 4-page bulletin on the filtration of quenching oils with Delpark industrial filters. The brochure includes data on the changes in oils which occur when the oil is subjected to repeated quenching operations. This bulletin tells how the heat exchangers are kept free from sludge, the efficiency of quenching oils retained, and high quenching quality of parts held constant through the use of Delpark filters. 10

WIRE ROPE ASSEMBLIES—American Chain & Cable Co., Inc., Wilkes-Barre, Pa. 24-page bulletin TL 500, describing the complete range of Tru-Loc fittings and wire rope assemblies. Data is given on construction features, applications, and breaking strengths. Among the fittings illustrated are yokes, sleeves, standard buttons, straight hole eyes, round eyes, hooks, balls, aircraft terminals, and straps selected to meet the widest variety of industrial applications. 11

INSERTS AND BLANKS—Carboloy Department of General Electric Co., Detroit, Mich. Two bulletins, one covering cemented oxide grade 0-30, the other the new finishing grade 330 carbide. Bulletin GTO-102 details both sizes and shapes of cemented oxide 0-30. Bulletin GT-311 covers specifications for high titanium, nickel binder grade 330 finishing carbide, including blanks for cylindrical and square boring tools. ..12

CUTTING AND GRINDING MACHINES—Covel Mfg. Co., Berton Harbor, Mich. Bulletin 125, describing the No. 12A cutter and tool grinder equipped with a Pope 1-H.P. direct motor driven tilting swivel spindle. Clearance angles can be readily and easily determined with the aid of the scale. Magnetic reversing motor control with oil-tight push-button stations at front and rear is furnished as standard equipment. 13

GRINDING MACHINES—Wesson Co., Detroit, Mich. 6-page bulletin describing the Poweramic oscillating tool grinder designed for offhand grinding of standard and special single-point carbide tools. The grinder has three motors—one for the wheel spindle, one for the grinding wheel, and one for the self-contained coolant pump system. 14

STAINLESS PIPE AND TUBING—Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Folder TDC-182, furnishing pertinent information on various machining operations on stainless pipe and tubing. Tooling, power requirements, cutting oils, and finishing are briefly described along with such machine operations as drilling, threading, reaming, milling, and sawing. ..15

ROLLER BEARINGS—Link-Belt Co., Chicago, Ill. Bulletin 2658, describing Series S adjustable single-row self-aligning roller bearings; Series D adjustable double-row bearings; and Series M preadjusted double-row self-aligning bearings. Engineering selection information, complete dimensional specifications, and recommended fitting practices are given. 16

PRESSES—Danly Machine Specialties, Inc., Chicago, Ill. 28-page booklet describing the company's double-action straight-side presses ranging from 200- to 2000-ton capacities. One-, two-, and four-point suspension presses are included. Special features of Danly presses such as adjustable, extra-heavy side connections, extra-long gibbing, automatic oil lubrication, and the Danly "Micro-inching" drive are shown in detail. 17

CUTTING TOOLS—Kennametal, Inc., Latrobe, Pa. 12-page folder B-301 illustrating Kendex tooling with button type "throw-away" inserts. The Kendex features include solid Kennametal chip breakers and shims for insert seats. More than 200 tools are listed in seventeen holder styles, eleven of which are negative rake and the others positive rake. 18

GEAR SHAVING MACHINE—National Broach & Machine Co., Detroit, Mich. 4-page bulletin describing the Red Ring Model GCP-24-inch gear shaving machine. Operating principles, cutter-head and spindle, machine table, and machine drive are discussed in detail. Close-up views showing the operation of the swivel work-head and cutter attachments for shaving internal gears are also included. 19

SINGLE-CRANK PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 64H Supplement, introducing the company's single-crank straight-side presses. These presses feature enclosed construction, triple box section design, great shut height, long slide adjustment, box type welded steel sides, barrel type connections, and an electropneumatic clutch control. Models available from 100- to 400-ton capacities. 20

AUTOMATIC CONTROLS—Automatic Temperature Control Co., Inc., Philadelphia, Pa. Catalogue D-31, illustrating and describing the products and services offered by the company in the field of automation. Some of the products covered are differential transducer control and automation systems, a complete line of time control equipment, valves, counters, and electronic contactors. 21

GEAR DEBURRING AND CHAMFERING MACHINES—Modern Industrial Engineering Co., Detroit, Mich. Bulletin BM-1, containing information on the complete line of Burr-Master gear deburring and chamfering machines. Illus-

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

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NEW SHOP EQUIPMENT

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trations, size dimensions, and other pertinent information are included for nineteen standard internal, external, and Duplex Burr-Master models. 22

CHUCK CONTROL—DoALL Co., Des Plaines, Ill. Bulletin describing "Selectrons" for automatic control of magnetic chucks. Contained are details concerning the method of obtaining DC power from the rectifier, the principle involved in the infinitely variable control of holding power, and the automatic demagnetization of chuck and work. 23

RIBBON BURNERS—Selas Corporation of America, Dresher, Pa. Bulletin SC-1004, describing the company's gas-fired heating units which produce a narrow, uniform sheet or "ribbon" of flame. They are usually employed in continuous heat-processing applications in the glass, printing, textile, metal-fabricating, and wire industries. 24

AIR-OPERATED CONVERSION UNITS—Renco-Toledo, Inc., Toledo, Ohio. Specification sheet on the company's air-operated conversion unit with micro-action, air-operated directional valve. Unit converts hand-powered machine tools to fully or semi-automatic operation. Included are photographs, scale drawings, construction data, specifications, and prices. 25

INDEXING MECHANISMS — Ferguson Machine & Tool Co., St. Louis, Mo. Catalogue 106, giving full selection and application data on the company's high-speed indexing mechanisms now available from stock. The catalogue also introduces the "Trans-Pac," a standard packaged power unit for indexing straight-line assembly machinery. . . .26

COLLETS—Sutton Tool Co., Sturgis, Mich. Bulletin No. 10, describing collets for lathes, milling machines, and grinders. Contained is also a list of the popular lathes and grinding machines and their respective collet numbers; complete ordering instructions, and price and specification table. 27

WELDING MACHINES—Sciaky Bros., Inc., Chicago, Ill. Bulletin 335-1, describing the company's Type SPT-1 spot welder and the EPT-1 projection welder. Both machines are air-operated, press type, patented three-phase and designed to cover a wide range of commercial welding applications. 28

CUTTING TOOLS—Stupakoff Division, Carborundum Company, Latrobe, Pa. Bulletin 156, describing Stupalox, a high-strength oxide cutting tool. In addition to physical and mechanical properties, the bulletin includes detailed data on a series of machining trials. 29

SPRAY PAINTING MACHINE—Conforming Matrix Corporation, Toledo, Ohio. Brochure describing and illustrating the company's air-operated, electrically controlled spray painting machine designed for spraying areas up to 12 inches wide and 40 inches long. . .30

UNIT FOR SPECTROCHEMICAL ANALYSIS — Jarrell-Ash Co., Newtonville, Mass. Catalogue V2-56, describing the JAco Variscource, an all-in-one excitation unit for spectrochemical analysis. A completely redesigned model of an earlier instrument, the unit is made in three standards models. 31

ULTRASONIC SYSTEMS — Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y. 4-page bulletin entitled, "Ultrasonic Barrier Broken by Low Cost Power Supply," describing various ultrasonic power supplies, transducers, and systems offered by the company for small- and large-scale production requirements. .32

PRECISION BEARINGS—Industrial Tectonics, Inc., Ann Arbor, Mich. 32-page catalogue AFB-1, giving information on anti-friction bearings for special applications. Dimensions and load ratings are given for single-row, double-row, deep groove radial, and angular contact bearings. 33

MANUAL MOTOR STARTERS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6358, giving new application information on the company's CR 1061 and CR 1062 manual starters for fractional and integral motors to 7 1/2 H.P. . . .34

PRESS BRAKE—Dreis & Krump Mfg. Co., Chicago, Ill. 4-page bulletin 131-56, illustrating and describing the design and construction features with complete specifications of their Model 131, 11-ton capacity CHICAGO press brake. .35

BEARING ALLOYS—Mueller Brass Co., Port Huron, Mich. Folder describing the company's "600" series—a group of forgeable bearing alloys having the high strength inherent in a forging. 36

AUTOCLAVES—Philips & Davies, Inc., Kenton, Ohio. Pamphlet describing and illustrating autoclave machines, for use where heat under pressure is required to process material. 37

SAFETY CONTROL—Security Controls, Inc., Buffalo, N. Y. Folder SCI-200-1, describing the company's electrical safety control system for machines with mechanical tripping mechanisms. 38

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SOLVENT DETERGENT—Oakite Products, Inc., New York City. Folder describing the properties of a solvent detergent. The material, Oakite Composition No. 98, was designed for use in power washing machines. 39

MINIATURE BALL BEARINGS—New Departure Division of General Motors Corporation, Bristol, Conn. Illustrated booklet containing essential information for proper selection and application of the company's line of miniature bearings. 40

DATA SHEETS—Micro Switch, a Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Leaflets P108 and P109, describing the company's subminiature door interlock switch and "electrical memory" toggle switch, respectively..41

GUIDE PINS AND BUSHINGS—Lamina Dies & Tools, Inc., Oak Park, Mich. Catalogue covering the company's entire line of equipment which includes guide pins, and accessories. 42

VISES—Illinois Metal Products, Chicago, Ill. 8-page brochure illustrating and describing the IMP "hold down" vises. Illustrations and application photos show how to save set-up time and increase production. 43

AUTOMATIC WELDING MACHINES—Morton Mfg. Co., Muskegon Heights, Mich. Bulletin No. 55, describing the company's heavy-duty column type welder and a variety of other welding equipment. 44

AUTOMATIC SCREW MACHINES—Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing all of the various sizes and models of Cleveland single-spindle automatics built by the company. 45

LUBRICATORS—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin 3C, describing the company's semi-automatic lubricators that can service as many as 100 or more bearings on a machine. 46

FOLDERS AND BRAKES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 74, presenting the modernized lines of Niagara folders and brakes, both air- and hand-operated models. Clearly described and illustrated are the company's adjustable bar folders, foot brakes, and universal folders and brakes. Complete details and specifications are given for each of the models. 47

STAINLESS STEEL—Washington Steel Corporation, Washington, Pa. 16-page illustrated booklet describing the physical properties and analysis, relative corrosion resistance, fabrication, application, and care of MicroRold Type 430 nickel-free stainless-steel sheet. 48

SURFACE GRINDER—Abrasive Machine Tool Co., East Providence, R. I. 8-page catalogue giving a comprehensive description of the company's No. 1 1/2 hand-feed precision surface grinder. 49

BARREL FINISHING—Lord Chemical Corporation, York, Pa. 40-page booklet describing the company's Lorco method of precision barrel finishing for metals and plastics. 50

INDUCTION HARDENING—Process Machinery Division, Cincinnati Milling Machine Co., Cincinnati, Ohio. Illustrated pamphlet describing the company's induction hardening machines. 51

ELECTRONIC FORMULATION — Bay State Abrasive Products Co., Westboro, Mass. Illustrated booklet describing the company's electronic formulation process. 52

CUTTING TOOLS—Sintox Corporation of America, Allentown, Pa. Bulletin describing and illustrating the company's line of cutting tools for all materials. 53

PRECISION HOLDING DEVICES—Heinrich Tools, Inc., Racine, Wis. Catalogue No. 156, describing the company's line of precision holding devices. 54

VISES AND FIXTURES—Universal Vise & Tool Co., Parma, Mich. Catalogue 9155, describing the company's line of vises and work-holding fixtures 55

FITTINGS AND FLANGES—Tube Turns, Louisville, Ky. Folder describing TUBE-TURN wrought-iron welding fittings and flanges. 56

DRILL JIG BUSHINGS—W. F. Meyers Co., Bedford, Ind. Illustrated folder giving data and specifications on the company's carbide-inserted drill jig bushings. 57

CONTROL VALVES—Valvair Corporation, Akron, Ohio. 6-page bulletin SK356, giving information on the company's line of Speed King pilot-operated control valves. 58

GAGING SYSTEMS—Federal Products Corporation, Providence, R. I. Catalogue 56 AM, describing the company's line of automation gaging systems and standardized control units. 59

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52 53 54 55 56
57 58 59

NEW SHOP EQUIPMENT

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115 116 117 118 119 120 121 122 123 124 125 126 127 128
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143 144 145 146 147 148 149 150 151 152 153 154 155 156
157 158 159 160 161 162 163 164 165 166 167 168 169 170

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Introducing the COMET

An Advanced Conception of Valving by Ross!

- Direct solenoid operated, balanced spool 4-Way—for air or oil service.
- Engineered and built to tolerances of .0001".
- Conforms to JIC standards.
- Complete valve cycle within 0.033 sec.
- Made of aluminum—single solenoid, base mounted weighs only 3½ lbs.
- Working surfaces almost as hard as a diamond.
- Small and compact—7¼" by 3½" by 3⅞". ¼" diameter flow capacity.
- Available with ¼" or ⅜" pipe tap for inline, manifold or base mounted; single solenoid spring return, double solenoid momentary; double solenoid three position.

Write, wire or phone for complete information

ROSS Control VALVES

Ross OPERATING VALVE COMPANY

110 E. GOLDEN GATE AVENUE • DETROIT 3 • MICHIGAN

use, and is designed to compete with and replace old style hand-pumped machines. Features include finger-tip load application, long stroke to eliminate anvil height adjustments, provisions for maintaining accuracy of loads well within A.S.T.M. standards, and construction designed to insure long dependable service with a minimum of maintenance requirements. Operator applies the load by depressing a lever on the side of the machine—holding it down for the desired time interval. Releasing the lever releases the load instantly. The load is controlled by a time-tested relief valve and can be clearly verified on the sensitive hydraulic load gage. Vertical opening is easily adjustable from a maximum of 9 inches to theoretical zero. Throat depth is 6 inches. The unit occupies an area of 9 by 25 inches.

Circle Item 157 on postcard, page 219

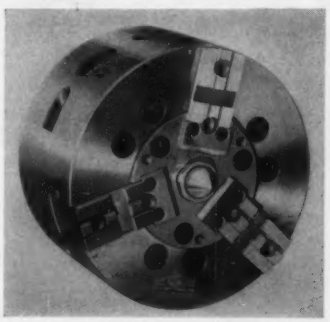
Continental Quick-Change Tool-Holder

Continental standard drive tool-holder that grips the cutter rigidly while the work is in process, yet permits the cutter to be instantly detached and replaced by a twist of the wrist. Continental Tool Works Division of Ex-Cell-O Corporation, Detroit, Mich., manufacturers of this holder, maintain a large stock of counterbores and countersinks in all standard sizes which are interchangeable in the holder. Boxed sets of counterbores, countersinks, and holders are stocked for immediate delivery to tool-rooms, small production shops, maintenance departments and job shops.

Circle Item 158 on postcard, page 219

Skinner Compensating Power Chucks

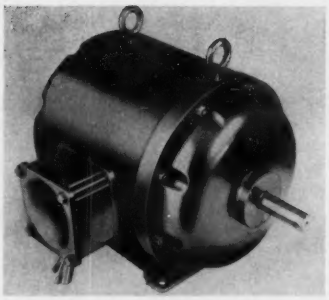
Three-jaw compensating power chuck of new Series 13100-A line announced by the Skinner Chuck Co., New Britain, Conn. These chucks are made in 8-, 10-, 12-, and 15-inch sizes for direct mounting on American Standard Types A-1, A-2, B-1, and B-2 flanged spindle noses. The chucks have forged steel bodies and are used to drive work on centers when high-speed, heavy-duty cuts are required. The high-speed tool steel center fits a standard Morse taper hole in the center plate. The 8-inch chuck features 1/16-inch compensation, and the 10-, 12-, and 15-inch chucks have 1/8-inch compensation, per jaw, which is sufficient for gripping castings, forgings, and other rough materials which have normal variations in size and errors in centering. Compensating action is achieved through three levers and a floating rocker. When power is applied, the draw-bar pulls the rocker which actuates the three levers and three jaws. Equal pressure to all jaws is assured, regardless of their gripping position on even or uneven work.



Circle Item 159 on postcard, page 219

Explosion-Proof Motor

One of a complete line of explosion-proof motors ranging through N.E.M.A. frames 405 and 215 brought out by Sterling Electric Motors, Inc., Los Angeles, Calif. These motors are designed to meet underwriters' requirements for the three most common hazardous locations: gaseous, explosive dust, and explosive grain dust. They are specially treated to resist moisture, dust, and corrosive atmospheres, and feature extra long flame-paths at shaft and bracket fits and fully sealed, prelubricated ball bearings. Available in standard, geared, or variable-speed models, with optional mountings to meet individual requirements.



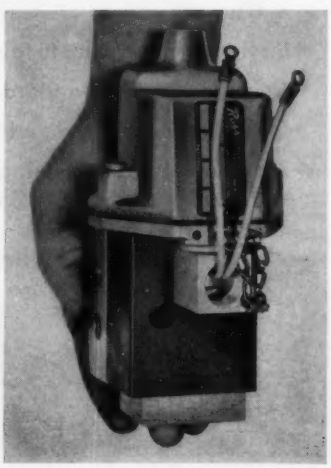
Circle Item 160 on postcard, page 219

Ross Multi-Purpose Valve

Multi-purpose valve called "Comet II," brought out by the Ross Operating Valve Co., Detroit, Mich. The basic design of this valve is said to provide for more than 100 model variations covering a wide range of air and oil pressure applications. For example, the valve can be easily adapted for use with a power welding gun and air-operated transfer mechanisms, as well as air-riveting and testing fixtures. This extremely quick-acting valve completes a cycle within 0.033 seconds. It has working surfaces almost as hard as a diamond and is built to tolerances of 0.0001 inch. Available tapped for 1/4- or 3/8-inch pipe and for in-line, manifold, or base mounting; and in single-solenoid spring-return, or double-solenoid momentary and double-solenoid three-position types. These solenoid direct-operated four-way spool type valves can be used for straight-way or three-way functions.

Circle Item 161 on postcard, page 219

(This section continued on page 228)

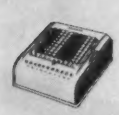


FOUND WHERE FINE BUSINESS MACHINES ARE "BORN"

GRAND RAPIDS GRINDERS

INTERNATIONAL BUSINESS MACHINES

SMITH-CORONA



COMPTOMETER

REMINGTON RAND

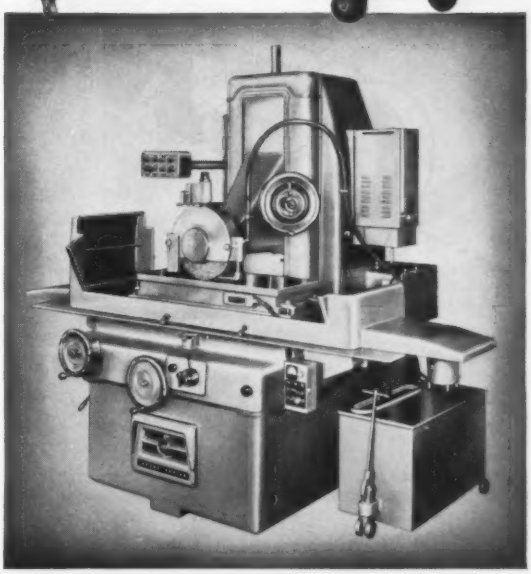
UNDERWOOD

R. C. ALLEN

Producing an intricate business machine requires exceptional toolroom precision. That's why these manufacturers use Grand Rapids Grinders . . . engineered to achieve extraordinary grinding precision at cost-cutting speed.

Model No. 560, at right, offers such features as one-piece column and base for permanent, vibrationless alignment, wheel head with powered rapid vertical travel, hydraulically actuated cross feed and longitudinal travel table. And it's the fastest grinder of its size and type, with a variable table speed up to 140 fpm!

Whether you make business machines or bulldozers, you can count on Grand Rapids Grinders for maximum toolroom precision.



GRAND RAPIDS NO. 560 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 140 fpm. Working surface of table is 14" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1800 and 2140 rpm.

A note on your letterhead will bring complete details.

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S.W., Grand Rapids, Michigan

Here's
BRY-ALIGN
CENTANT

what you've been asking for–

the new Bryant "Centalign"

Automatic Internal Grinder

Designed and built to your requirements (as expressed to us over several years) for a machine capable of high production, lower-cost internal grinding, embodying the latest developments in shoe centerless grinding and adapted to automated lines. Ask for a demonstration.

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

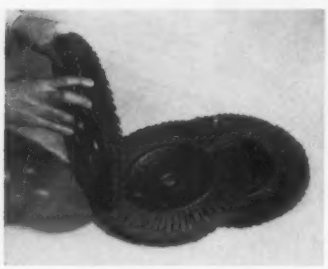
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers

For more information fill in page number on Inquiry Card, on page 219

Sectional Buffing Wheels

Pleated type sectional, abrasive-impregnated wheels for buffing all ferrous and non-ferrous metals developed by the Coated Abrasives Division of the Carborundum Company, Niagara Falls, N. Y. Designed to reduce or eliminate the need for abrasive cake and compound in stick or liquid form, such as applied to non-impregnated buffs, these wheels effect a considerable saving in finishing costs. Made of specially treated bias cloth, impregnated with selected abrasive grains in the finer grit sizes for normal "cut-down" operations to prepare surfaces for color buffing, plating, or both. Also made in the coarser grit sizes for



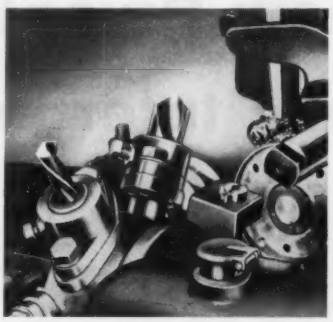
work ordinarily performed by set-up wheels, coated abrasive belts, brushes, and other polishing and buffing devices.

Circle Item 162 on postcard, page 219

"Mikemaster" Gage Set for Testing Micrometers

Master gage set of pyramid design for testing the accuracy of shop micrometers, called "Mikemaster," introduced by the Size Control Co., Chicago, Ill. This instrument consists of six lapped, hardened, and normalized steel cylinders graduated in size from 1 to 6 inches in diameter. To check his micrometer, an operator just slips it over one of the cylinders to see if the micrometer reading agrees with the cylinder size. The cylinders, pyramided one atop the other, are permanently attached to a wooden base. They are made to Class Y accuracy and calibrated to four decimal places.

Circle Item 163 on postcard, page 219



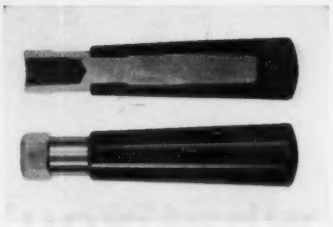
Short-Length Drills for Screw Machines

Whitman & Barnes, Plymouth, Mich., are manufacturing a series of high-speed, straight-shank, short-length drills for use in screw machine drilling operations. The web thickness, flute contour, and spiral of these drills have been designed for easy penetration, efficient chip removal, and long life between resharpenings. The initial cost of the drills is said to be less than that of regular length drills, and there is no expense involved in cutting off, repointing, and web thinning as when full-length drills are used. These screw machine drills are available in fractional, wire gage, and letter sizes in both right- and left-hand styles.

Circle Item 164 on postcard, page 219

Plastic Handles for Machine Tools

All-purpose, molded plastic handles for machine tools, tractors, chain saws, dies, fixtures, and numerous other uses developed by the Chicago Screw Co., Division of Standard Screw Co., Bellwood, Ill. These handles, originally designed for a prominent manufacturer of crawler type tractors, are said to have advantages over the conventional type steel handles. Steel cores assure an exceptionally tight fit and fast, easy assembly. Testing at sub-zero and tropical temperatures indicated that



they will withstand extreme weather conditions. During impact tests the handles withstood shock and intense vibration. No separation occurred between the steel core and the handle. The hands have glossy black finish and heavy bright cadmium-plated inserts. Stocked in 7/16-20 and 1/2-20 U.N.F. sizes.

Circle Item 165 on postcard, page 219

Millers Falls "Deep-Cut" Hole Saws

"Deep-Cut" hole-saw kit No. 1741 for pipefitting, sheet metal, plumbing, electrical, and general maintenance work announced by Millers Falls Co., Greenfield, Mass. Complete with two mandrels in steel box 6 by 4 by 3 inches. The saws (in sizes from 1 1/16 to 2 9/16 inches in diameter) have special high-speed steel cutting edges, welded to tough chrome-vanadium bodies. The sharp cutting teeth, four to the inch, are said to bite quickly through most any building material, cutting pipes

and tanks, ordinary nails, screws, metal lath, and many other obstructions in floors, walls, and partitions. The regular depth of cut is 2 1/2 inches but deeper cuts can be made by removing the core. Both mandrels included in the kit have 7/16-inch hexagonal shanks and 3/8-inch pilot drills.

Circle Item 166 on postcard, page 219

Granite City saves fuel, raises production and quality with Cities Service Heat Prover!

Nation's 14th largest steel producer uses Heat Prover on soaking pits, open hearth furnaces and on their annealing furnaces.

Granite City Steel burns enough fuel in one year to heat a five-room house for 38,000 years!

Obviously, if this fuel burns inefficiently, the loss could be staggering. But Granite City has no worries on that score. "Thanks to the portable Cities Service Heat Prover, we get better fuel efficiency, better quality, greater production than ever," they report.

"Because it provides a quick, highly accurate check of fuel-air ratio, the Heat Prover has proved invaluable in controlling combustion conditions in open hearth furnaces, soaking pits, and annealing and normalizing furnaces. In a matter of seconds it tells our engineers how efficiently the furnaces are working—whereas former tests often took hours and didn't provide as accurate a picture. Anyone in this business can probably benefit from this ingenious device."

Supplied and maintained free by Cities Service, the remarkable Heat Prover is today used and applauded by scores of major steel producers. If you'd like to learn how it could simplify your operation as it has theirs, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

20TH CENTURY BLOWGUN—a bazooka—is readied by technicians for tapping open hearths. They are part of Granite City's 4800 skilled employees.

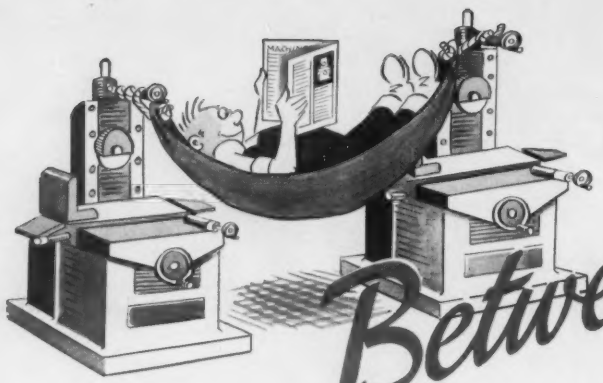
HEAT PROVER AT WORK at back of open hearth furnace. In minutes it provides accurate check on furnace efficiency—saves hours required by former testing.

CONTROL TOWER at blooming mill guides ingots as they pass through rollers. Granite City has capacity of 1,200,000 net tons of ingots annually.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 219



Between Grinds

By E. S. Salichs

Whiffle While You Work

After reading an item about scenting air for promotional purposes, the advertising manager of a prominent air-gage manufacturer allowed his thoughts to billow, so to speak, on what could happen if odoriferous air were used in gaging operations. Inspection of manufactured parts by precision air gages involves the principle of measuring the flow of air between the part to be gaged and a tool which is inserted into the part, as most of us know. Thus the operator works in an atmosphere made up chiefly of the air escapement from gages.

Insertion of scent cartridges into the air lines at each gaging station becomes a practical possibility. On this premise, the manager gave vent to his imagination and jotted down some problematical case histories, two of which we offer here:

A union steward, whose theme was "Management and this factory stinks," emptied a noxious odor vial into the regulating and filter system of an air gage, and consequently workers were on the verge of believing his statements. But management quickly counteracted by pouring Berlum (an extract exuding an atmosphere of free lunch and stale beer) into the system, most conducive to employe rapport.

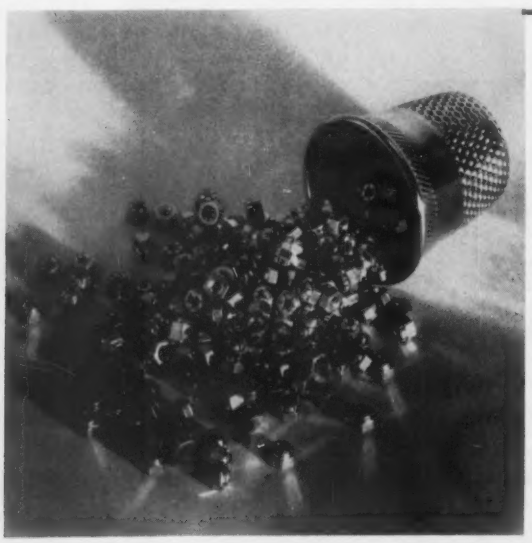
In a candy bar factory where air gages were used to control the thickness of the chocolate coating, employes were permitted to eat scrap during rest periods. In time, however, increased avoirdupois of the workers created a dangerous floor-loading problem. Management inserted Eau de Esquimo (French for What Smells) into the air stream. Appetites failed, and both flooring and figures were saved.

Eye- and Tooth-Catching Name

The Gold Filled Leather Works, of Bombay, India, recently wrote to the Editor requesting the addresses of steel companies in the U.S.A. which could handle its requirements for cold-rolled steel sheets.

No Industrial Wallflowers

Is your company lonesome for a mate? A "marriage broker" who brings together scattered producers turning out a variety of products was described recently in the *New York Herald Tribune*. Actually, the service consists of "bringing together plants with undeveloped production potentials and producers in search of new products to market." And, in this union, the wedding bells have a truly metallic ring.

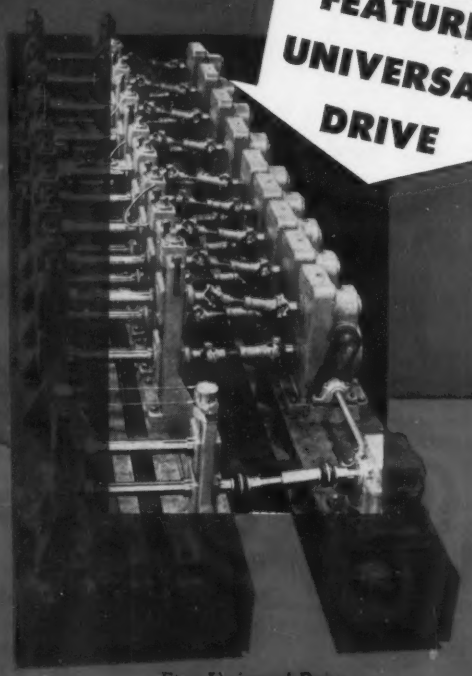


JACK BE NIMBLE WITH WHAT'S IN THE THIMBLE—261 lock-nuts the photographer counted as he packed a thimble and then spilled them out in an effort to show how really small these S-P-S (Standard Pressed Steel) lock-nuts are. The lock-nuts are intended for use in instruments and electronic devices and are made in one piece of brass or aluminum, in sizes from No. 0 —80 threads per inch (as shown in the picture) up to No. 4—48 threads per inch.

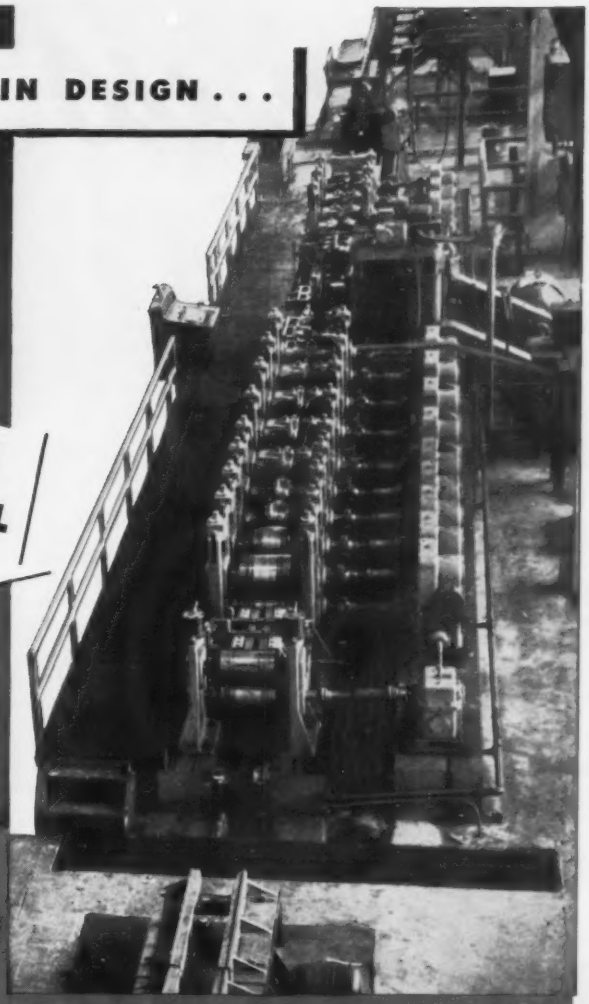
LEADING THE INDUSTRY IN DESIGN . . .

Etna TUBE MILLS

FEATURE UNIVERSAL DRIVE



Etna Universal Drive



You'll notice a trend toward Etna's modern machine design. Etna has sold more Universal Drive Mills than all other manufacturers combined. The Universal Drive provides greater accuracy in the forming of the tube, and allows an easier change from the manufacture of one diameter tube to another.

PERMANENT OIL COOLED TRANSFORMER

For greater efficiency an *Oil Cooled Transformer* is incorporated into the machine. It is a *permanent unit* and *never has to be replaced*. Cooling with oil eliminates the necessity to dry out the transformer after each days work, which is necessary when water is used as a transformer coolant. Etna Mills . . . Built for continuous operation. Write for complete details.

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

For more information fill in page number on Inquiry Card, on page 219

News OF THE INDUSTRY

California and Oregon

SHEFFIELD CORPORATION, Dayton, Ohio, announces establishment of the Sheffield Western Sales Corporation, 11323 W. Washington Blvd., Culver City (postal address: Los Angeles 66), California, as direct sales branch. The new office will be staffed by DONALD A. BENBOW, branch manager, assisted by RICHARD A. BROERMAN, formerly of the Midwest territory, and CHARLES G. TUCKER, sales engineer.

HENRY C. MILLER has been appointed national sales manager, Milling Machine Department of the AXELSON division of U. S. INDUSTRIES, INC., Los Angeles, Calif. Mr. Miller was previously assistant sales manager of ELMES and KING division of the AMERICAN STEEL FOUNDRIES Co. in Cincinnati, Ohio.

Henry C. Miller, sales manager of Axelson Mfg. Co.

PLATT ELECTRIC SUPPLY, INC., 1305 N.W. Davis St., Portland, Ore., has been appointed distributor for the Clark Controller Co., Cleveland, Ohio.

IVAN E. HOWARD was appointed general service manager of the Lamson Mobilift Corporation, Portland, Ore.

Illinois and Wisconsin

BARBER-COLMAN CO., Rockford, Ill., announces the expansion of service facilities in the Philadelphia, Buffalo, and New York areas. JOHN B. MOORE and EDWARD W. SULLIVAN have joined the service engineering staff at the Wheelco Philadelphia office. The new service engineer with the Wheelco Buffalo office is JAMES T. SHELTON, and WALTER GILMORE is associated with the Wheelco New York office in the same capacity.

STEPHEN L. INGERSOLL was elected president and general manager of the Ingersoll Steel Division of Borg-Warner Corporation, Chicago, Ill. He succeeds H. G. Ingersoll who has retired from that position. After having served as vice-president of the Ingersoll Steel Division since 1930, Stephen L. Ingersoll was elected executive vice-president in June, 1954. He first joined the division in 1920.

O. JULES POUPITCH has been appointed head of a new development program of the Research and Product Development Division of Illinois Tool Works, Chicago, Ill. Mr. Poupitch has also been named product development consultant for both the company's fastening divisions—the recently established Fastex Division and the Shakeproof Division.

EKSTROM, CARLSON & CO., Rockford, Ill., announce the appointment of NEFF KOHLBUSH & BISSELL, 5700 W. North Ave., Chicago, Ill., as distributors for their line of vertical milling machines for ferrous metals. They will cover the midwestern states of Illinois, Wisconsin, Indiana, Minnesota, and Iowa.

THOR POWER TOOL CO., Aurora, Ill., announces that plans have been made to move its executive administration offices to Chicago. Present executive offices in the company's Aurora headquarters will be retained to maintain supervision of Thor's principal administrative departments.

THOR POWER TOOL CO., Aurora, Ill., announces that its Denver branch office has been moved to larger quarters at 2704 W. Eighth Ave., Denver, Colo. Headed by C. H. GABRIEL, the branch serves Colorado, Utah, Wyoming, and parts of New Mexico, Idaho, Nevada, Oregon, South Dakota, and Montana.

PRODUCTION TOOL CORPORATION, Chicago, Ill., has purchased KUMA TOOL CO., Chicago, manufacturer of precision tools and equipment. Kuma Tool Co. will be operated as a division of Production Tool with present management to continue in charge.

LOREN GILLHOUSE has been appointed sales manager of Quincy Compressor Co., Quincy, Ill. Mr. Gillhouse assumes his new duties after five years as assistant sales manager. He also served as regional sales manager for the company.

PAUL ECKSTEIN was recently appointed sales representative for Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill.

DAVIS BORING TOOL DIVISION, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., announces the acquisition of KELLY REAMER CO., Cleveland, Ohio, including its entire stock. Kelly tools will be moved to Fond du Lac, where operations will be centralized and all tool stocks maintained. Replacement requirements for the Kelly line will be handled by Davis representatives and field tool engineers.

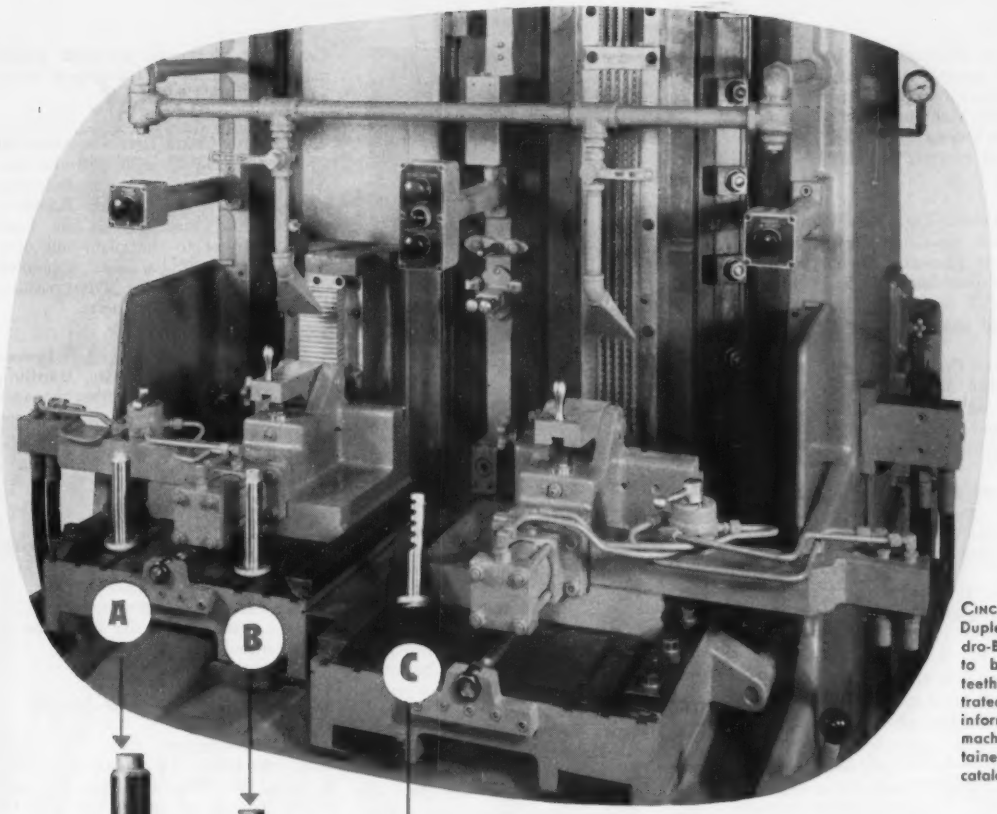
The Resistance Welding Department of AMPCO METAL, INC., Milwaukee, Wis., has announced the appointment of two distributors: FRANK BRANDT, 56 Jasper St., Saugus, Mass., and MOEHLEPAH ENGINEERING, INC., 501 Garver Bldg., Des Moines, Iowa. The new distributors will handle the complete line of Ampco-Weld electrodes and accessories.

Michigan and Minnesota

PROGRESSIVE WELDER SALES CO., Detroit, Mich., announces the appointment of RAY W. HEIDEN as director of manufacturing in charge of the company's entire manufacturing operations. At the same time is announced the appointment of RONALD L. LOUP as director of engineering for all the company's divisions.

WHITMAN & BARNES, Plymouth, Mich., announce the appointment of two sales engineers: BARRY SEDGWICK will serve distributors and customers in the Los Angeles area; and JERRY E. WIEDEMANN will operate from Houston, Tex., servicing distributors and customers in the southern Texas and Illinois territories.

CHARLES T. BUSH was appointed chairman of the board of the Chas. A. Strelinger Co., Detroit, Mich. He will continue as chief executive officer. Mr. Bush has been an officer of the company for forty-five years, the last twenty years as president.



CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach, tooled up to broach the rack teeth on parts illustrated here. Complete information on these machines may be obtained by writing for catalog No. M-1848.

Prior to Hydro-Broaching

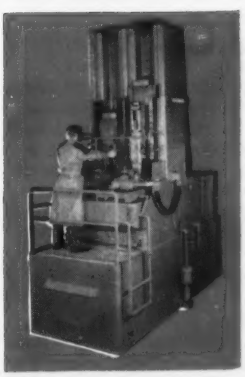
Flat Hydro-Broached in first station

Teeth Hydro-Broached in second station. Finish of teeth, 40 to 50 micro-inches; accuracy ± .0004" on linear pitch. Production complete, 100 per hour.

These Parts Get a Low Cost Set of Teeth

on CINCINNATI VERTICAL HYDRO-BROACH MACHINE

Surface broaching, as a machining operation, cut its teeth years ago. Today it is being applied to an ever-increasing variety of parts and operations, including the machining of rack teeth. Cincinnati Application Engineers know how to broach a low-cost set of teeth on short parts or yard-long parts. The most recent example of their work is illustrated here: a CINCINNATI No. 10-66 Duplex Vertical, with complete tooling, ready to broach the teeth on piston rod racks at the lowest cost. ¶The parts arrive completely turned and the stem rough ground. Rack teeth are broached in two progressive operations; a flat which forms the top of the teeth is broached in the left-hand station, and the rack teeth are broached in the right-hand station. Production, 100 per hour complete. ¶CINCINNATI Hydro-Broach Machines and Cincinnati Application Engineers form a team that just can't be beat in visualizing and building complete production packages for your work. These men are ready to help you solve your production problems. Why not write now, enclosing blueprints and complete details.



CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach. Catalog No. M-1848.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

For more information fill in page number on Inquiry Card, on page 219

JOSEPH MONTGOMERY has been appointed general sales manager of the Elox Corporation of Michigan, Clawson, Mich. Mr. Montgomery has been in the company's sales division for three years and most recently in charge of foreign sales.

FORMSPRAG CO., Van Dyke, Mich., announces election of two new vice-presidents. They are CHARLES F. TRAPP, JR., vice-president in charge of sales, and L. T. SZADY, vice-president in charge of engineering.

ECLIPSE COUNTERBORE CO., Detroit, Mich., has acquired all of the land, factory building, machinery, inventory and patent applications of WADELL TOOLS, North Branch, N. J.

RICHARD C. AYLWARD has been appointed general sales manager of Bohn Aluminum & Brass Corporation, Detroit, Mich.

GRANT S. WILCOX has been named plant manager of Ross Operating Valve Co., Detroit, Mich.

CHARLES J. CRAFT was appointed service manager for the Snyder Tool & Engineering Co., Detroit, Mich.

WESSON CO., Detroit, Mich., has appointed the STONE CO., INC., Minneapolis, Minn., as representative throughout Minnesota and western Wisconsin. The appointment of SAMUEL MURPHY to the Detroit sales organization of the Wesson Co. has also been announced. Mr. Murphy was formerly with the Ford Motor Co.

New England

JAMES H. BLY has joined the sales division of High Voltage Engineering Corporation, Cambridge, Mass. He will work in sales and application engineering activities relating to use of the company's Van de Graaff supervoltage X-ray generators in industrial radiography.

NORTON CO., Worcester, Mass., has appointed two abrasive engineers. They are ROBERT N. HAMILTON and ROBERT P. COOPER. Both men were field engineers assigned to the Los Angeles district office. In this new territory assignment, they will each cover part of the city of Los Angeles.

VAN NORMAN INDUSTRIES, INC., Springfield, Mass., have announced the appointment of JAMES L. LEWIS as assistant to the president for administration and sales, and of PAUL C. EBERHARDT as assistant to the president for manufacturing and research.

PRATT & WHITNEY CO., INC., West Hartford, Conn., announces purchase of the assets and business of the JAQUITH CARBIDE DIE CORPORATION of Lynn, Mass.

Herbert I. Segal, newly appointed director of Van Norman Industries, Inc.

HERBERT I. SEGAL was appointed a director of Van Norman Industries, Inc., Springfield, Mass. Mr. Segal, who has been engaged in the machinery business or related fields since 1914, is also president of Segal Affiliates, Inc., New York City, business counsellors; chairman and director of Hasco Machinery Co., Newark, N. J., distributors of machine tools; and vice-president and director of Curtice-Lyle Properties, Inc., and Rochester Industrial Terminal, Inc., both of Rochester, N. Y.

FELLOWS GEAR SHAPER CO., Springfield, Vt., announces the following appointments: EDWARD W. MILLER, formerly president and general manager, has been elected president; EDWIN R. FELLOWS II, who was assistant general manager and export manager, was elected vice-president and general manager; WILLIAM H. FELLOWS was elected clerk of the company; and ALDRIEN CARLETON, formerly assistant export manager, was appointed export manager.

Edwin R. Fellows II, vice-president and general manager

AMERICAN CHAIN DIVISION, American Chain & Cable Co., Inc., Bridgeport, Conn., has announced the following personnel changes: A. M. ROBERTS, former chief metallurgist, has been made assistant to the plant manager, and C. H. RABB has been appointed chief metallurgist, filling the position formerly held by Mr. Roberts.

LEWIS H. WHITNEY was elected president of Whitney Chain Co., Hartford, Conn. At the same time, other management appointments were announced including EINAR A. HANSON as vice-chairman of the board and BRENNISS G. TYRELL as executive vice-president and treasurer.

THE TAFT-PEIRCE MFG. CO., Woonsocket, R. I., has appointed the MACHINE TOOL SALES CO., Division of TOOL SUPPLY & ENGINEERING CO., Dallas, Texas, to handle the sales of machine tools in the Dallas area.

New York and New Jersey

U. S. INDUSTRIES, INC., New York City, have acquired the assets of A-1 BIT & TOOL CO., Houston, Tex., who will retain its original name but will be operated as a branch of Garrett Oil Tools, Inc., a division of U. S. Industries, Inc.

THOMAS L. WARD was appointed manager of the ALCO PRODUCTS, INC. plant at Dunkirk, N. Y. He succeeds W. L. LARSON, who has resigned.

CLARK GREY was appointed general sales manager of AVNET ELECTRONIC SUPPLY CO., INC., New York City.

BREEZE CORPORATION, Union, N. J., has purchased the Slip Ring Division of P M Industries, Inc., Stamford, Conn.

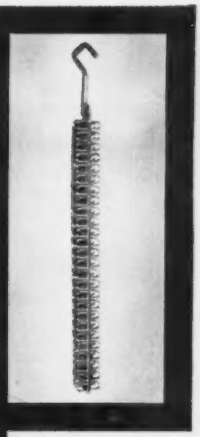
Ohio and Indiana

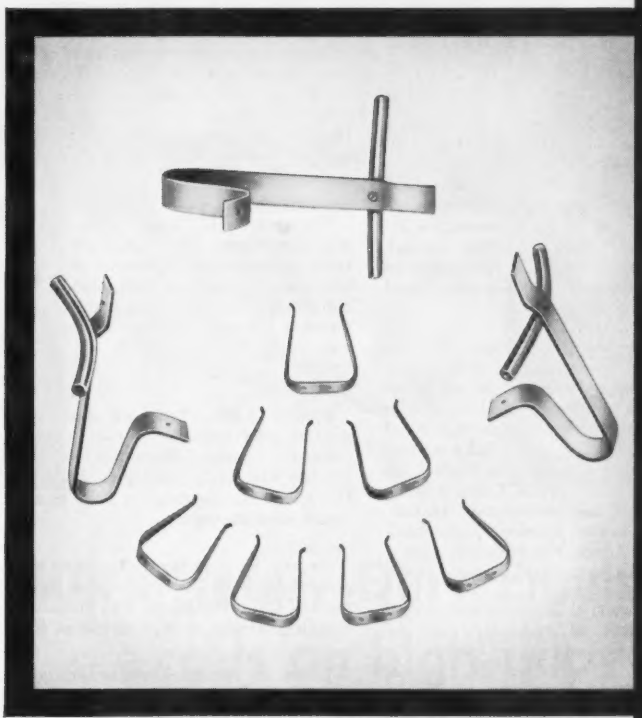
EATON MFG. CO., Cleveland 10, Ohio, announces the appointment of HOWARD J. MCGINN as chairman of the board, succeeding CLARENCE I. OCHS who was immediately elected chairman of the executive committee and will continue as a director of the company. Mr. McGinn succeeded Mr. Ochs as president in 1951 and will continue in that office as well as assuming his new position.

ROLL FORMED PRODUCTS CO., Youngstown, Ohio, appointed NORTHEASTERN ASSOCIATES, INC., 12 E. Bridge St., Oswego, N.Y., as representative in central New York State.

WILLIAM L. PARCELL has been named vice-president of the Ridge Tool Co., Elyria, Ohio.

Spring quality of
REVERE
PHOSPHOR BRONZE
—important to Higgins Rack

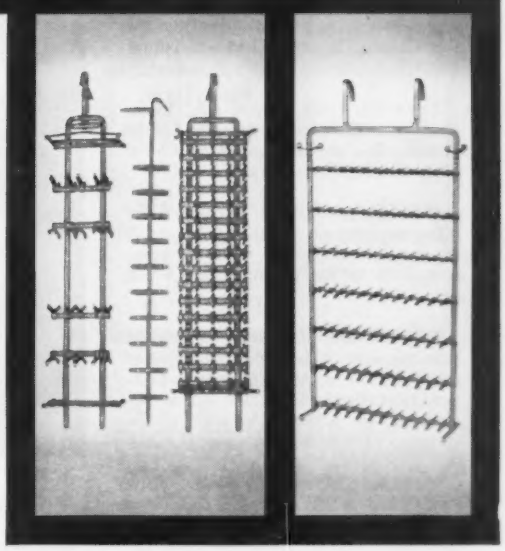




When small parts have to be plated, the problem arises as to how to hold them on the plating racks. If they are not heavy enough to hang by their own weight, spring clips must be used. For such clips, the Higgins Rack Coating Mfg. Co., Hazel Park, Mich., uses spring temper Revere Phosphor Bronze Strip. This material is specified because its spring temper gives it the ability to withstand repeated flexing, so that the clips can be used repeatedly, and that small parts can be snapped in and out of them quickly and without distortion.

The racks to which these clips are attached are made of copper bar; the clips are fastened by riveting and soldering. Everything except the contact points of the clips is coated to prevent deposition of the plating metal and loss of current. Higgins is an important supplier of these special racks to the automotive industry, which uses them to plate both interior and exterior trim. The efficiency and economy of this method helps make handsomer cars and trucks as well as numerous other attractive consumer commodities.

Clips and racks made to special designs by the Higgins Rack Coating Mfg. Co., which buys Revere Phosphor Bronze Strip for the clips from Copper and Brass Sales, Inc., a Revere Distributor in Detroit, Mich.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

* * *

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities, Distributors Everywhere.

Trout-Ware

J. B. Perkins, president of the Hill Acme Co.

HILL ACME CO., Cleveland, Ohio, announces appointment of the following officers: J. B. Perkins, president; L. L. Hercik, vice-president and general manager; J. R. Short, secretary; A. C. McDaniel, Jr., assistant secretary; K. F. Bruch, Jr., treasurer. Former president A. C. McDaniel, Sr., becomes active chairman of the board.

CLEVELAND CAP SCREW CO., Cleveland, Ohio, has appointed EMIL J. UNGER to the inside sales force in charge of a territory including all of Michigan and the Chicago area.

HAROLD RUEHL has been appointed chief engineer of Erickson Tool Co., Cleveland, Ohio. His appointment fills the position left open by the death of Robert F. Jacobs.

TECHNEERING SALES, INC., 53 Park Ave., Dayton, Ohio, has been appointed representative in southwestern Ohio for the GEORGE SCHERR OPTICAL TOOLS, INC.

LIMA ELECTRIC MOTOR CO., Lima, Ohio, announces the opening of a branch office at 8905 Lake Ave., Cleveland, Ohio.

WILLIAM C. WARNER has joined the sales department of the Solar Steel Corporation, Cleveland, Ohio, to represent them in the metropolitan Detroit area.

WILBUR DEUTSCH was appointed sales manager of the Industrial Lubrication Department, ARO EQUIPMENT CORPORATION, Bryan, Ohio. He will be responsible for nation-wide sales of the company's lubricating equipment.

RICHARD E. WHINREY, general manager of Link-Belt Co's Ewart Ind. plant has been elected a vice-president of the company.

HERMAN E. HAPPEL was appointed director of research and development in charge of engineering research, product design, and development, of Atkins Saw Division, Borg-Warner Corporation, Indianapolis, Ind. Mr. Happel has more than twenty-years' practical experience in mechanical and electrical engineering.

Pennsylvania and Maryland

E. F. HOUGHTON & CO., Philadelphia, Pa., announce the following appointments: CHARLES A. BILLER has been named manager, foreign sales department. He was formerly assistant manager. He joined the company in 1952. ARMAND J. ANDRE, previously a representative in the company's Chicago sales division, was named to the newly created post of assistant sales manager of the Southern division, with headquarters in Charlotte, N. C. Mr. Andre has been with the company since 1939. WILLIAM EISMANN, formerly supervisor of lubrication and rust-preventive research, was appointed acting research manager, following the resignation of DR. K. C. FRISCH. Mr. Eismann joined the company in 1937.

KENNAMETAL INC., Latrobe, Pa., announces that sales of its products in foreign markets will be handled exclusively by a newly organized subsidiary, Kennametal Overseas Corporation. Sales representatives of the wholly owned subsidiary will be located in the Belgian Congo, Belgium, Brazil, Cuba, France, Italy, Japan, the Netherlands, Mexico, Panama, Norway, Sweden, Switzerland, and South Africa. The principal office is at Avenida Central 8-40, Panama, R. P.

DR. GEORGE A. ROBERTS was elected vice-president of technology of the Vanadium-Alloys Steel Co., Latrobe, Pa.

Dr. George A Roberts, newly appointed vice-president of technology, Vanadium-Alloys Steel Co.

Dr. Roberts joined the company in 1941, advancing from research metallurgist through the post of chief metallurgist to his present position. He is also a director of Vanadium-Alloys Steel Canada, Ltd.

ROCKWELL MFG. CO.'s Delta Power Tool Division, Pittsburgh, Pa., announces the appointment of four district sales managers in the Eastern and East Central regions: A. CARY HAWTHORNE, JR., Maryland district sales manager; FRANK T. GEARHART, Philadelphia-South New Jersey district sales manager; JAMES A. WEBSTER, JR., western New York district sales manager; and CHARLES S. ZOLLINGER, Pittsburgh district sales manager. Announced is also the appointment of GEORGE WULFF as Oregon district sales manager for the Delta Power Tool Division. The districts serviced by Mr. Wulff are Idaho, Montana, and part of Washington.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces two sales appointments: KENNETH M. ACTON, assistant manager of the company's San Francisco, Calif., sales branch; and THOMAS J. BEHAN, assistant manager of the company's Buffalo, N. Y., sales branch.

LESTER C. HILL has been appointed general sales manager of the VULCAN CRUCIBLE STEEL DIVISION, H. K. PORTER CO., INC., Aliquippa, Pa. Mr. Hill joined the company in 1953 as assistant sales manager.

GEORGE W. BLACKMORE has been appointed general manager of the Heppenstall Co.'s, Pittsburgh, Pa., materials handling division at New Brighton, Pa.

JAMES H. SUTHERLAND has been appointed to the position of midwestern regional sales manager of SKF Industries, Inc., Philadelphia, Pa.

COLIN G. WALCOTT has been appointed carbide service engineer in the Detroit district of the Firth Sterling, Inc., Pittsburgh, Pa.

ROBERT D. BLACK was elected president and chairman of the board of the BLACK & DECKER MFG. CO., Towson, Md. His appointment fills the vacancy caused by the recent death of ALONZO G. DECKER. At the same time, ALONZO G. DECKER, JR., was elected executive vice-president of the company. At the same time the company announces the opening of a factory sales and service branch in Pittsburgh, Pa., and an entirely new branch in Columbus, Ohio. The addition of the Columbus branch increases the number of service stations operated by the portable electric tool company to thirty-nine.

(*Continued on page* 242)

Sun's Heavy Duty Emulsifying Cutting Oil excels on high-alloy aircraft steels

S.E.C.O. Heavy Duty handles all machining jobs requiring an emulsifying cutting oil. Piasecki Helicopter's large job shop at Morton, Pa., found this out three years ago when S.E.C.O. HD* replaced two expensive heavy-duty soluble oils in machining fan hubs.

Extremely versatile and moderately priced, S.E.C.O. HD has been doing an exceptional job in cutting a variety of high-alloy aircraft steels for Piasecki.

For more information about S.E.C.O. HD, see your Sun representative. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-5.

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- *Cutting and Grinding Facts*
- *Disposal of Waste Emulsions*
- *New Improved S.E.C.O.*
- *S.E.C.O.—Mixing Instructions*
- *S.E.C.O. HD*

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*TRADE-MARK

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

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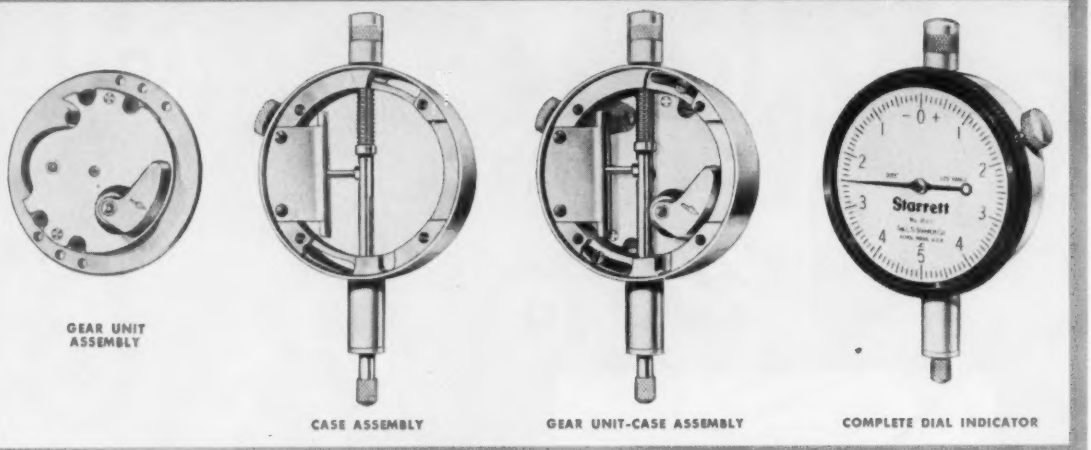
SIMPLE UNIT CONSTRUCTION

for Easier Maintenance, Longer Life, Greater Accuracy



One of the Many Outstanding New Features of

Starrett *HIGH PRECISION LOW FRICTION* Dial Indicators

(Patents Pending)

You can see at a glance how *Simple Unit Construction* makes the new Starrett *High Precision-Low Friction* Dial Indicators so easy to service and maintain. The entire gear mechanism is identical and interchangeable in all No. 25, No. 655 and No. 656 Regular and NON-SHOCK models. Any gear unit and any case assembly can be quickly combined to give you a complete dial indicator. No special techniques are required. Maintenance time and upkeep costs are reduced to the barest minimum.

Simple Unit Construction also means fewer parts for greater efficiency, less friction and wear, longer life. The new super-sensitive, low friction, low inertia movement with high efficiency gear train insures greater accuracy and sensitivity for exact duplication of repetitive readings.

Send for catalog describing the many outstanding features of Starrett *High Precision-Low Friction* Dial Indicators . . . the world's most complete line.

The L. S. STARRETT COMPANY, Dept. D
Athol, Massachusetts

Please send information on Starrett *High Precision-Low Friction* Dial Indicators.

Name.....Title.....

Company.....

Street and Number.....

City.....Zone....State.....

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR — Prompt delivery · Dependable service · Quality products

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"WORLD'S GREATEST TOOLMAKERS"

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MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS • DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

TABLE OF SURFACE SPEEDS PER MINUTE—I

Surface Feet Per Minute	40	50	60	70	80	90	100	110	120	140	160	180	200	250	300	350	400	450	500	600	Surface Feet Per Minute
Dia. In.	REVOLUTIONS PER MINUTE																				Dia. In.
¼	611	764	917	1070	1222	1375	1528	1681	1833	2140	2444	2750	3056	3820	4584	5348	6112	6882	7640	9168	¼
⅜	408	509	611	713	815	916	1018	1120	1222	1426	1630	1832	2037	2546	3056	3563	4074	4584	5092	6112	⅜
½	306	382	458	535	611	688	764	840	916	1070	1222	1376	1528	1910	2292	2674	3056	3438	3820	4584	½
⅝	244	306	367	428	489	550	611	672	733	856	978	1100	1222	1530	1833	2139	2445	2750	3056	3666	⅝
¾	204	254	306	357	407	458	509	560	611	714	814	916	1018	1273	1528	1783	2037	2292	2546	3056	¾
⅞	175	218	262	306	349	393	436	480	523	612	698	786	872	1090	1310	1528	1746	1964	2183	2620	⅞
1	153	191	229	267	306	344	382	420	458	534	612	688	764	955	1146	1337	1528	1719	1910	2292	1
1⅛	136	170	204	238	272	305	339	374	407	476	544	610	678	850	1019	1188	1358	1528	1698	2038	1⅛
1¼	122	153	183	214	244	275	305	336	366	428	488	550	611	764	917	1070	1222	1375	1528	1834	1¼
1⅜	111	139	166	194	222	249	277	305	332	388	444	498	554	695	833	972	1111	1250	1389	1666	1⅜
1½	102	127	153	178	204	229	254	280	305	356	408	458	509	637	764	891	1019	1146	1273	1528	1½
1¾	87	109	131	153	175	196	218	240	262	306	350	392	436	545	655	764	873	982	1091	1310	1¾
2	76	95	114	133	153	172	191	210	229	266	306	344	382	477	573	668	764	859	955	1146	2
2¼	68	85	102	119	136	153	170	187	204	238	272	306	340	425	509	594	679	764	849	1018	2¼
2½	61	76	92	107	122	137	153	168	183	214	244	274	305	382	458	535	611	688	764	916	2½
2¾	55	69	83	97	111	125	139	152	166	194	222	250	278	345	417	486	556	625	690	834	2¾
3	51	64	76	89	102	115	127	140	153	178	204	230	255	318	382	446	509	573	637	764	3
3¼	47	59	70	82	94	106	117	129	141	164	188	212	234	295	353	411	470	529	590	706	3¼
3½	44	54	65	76	87	98	109	120	131	152	174	196	218	270	327	382	437	491	540	654	3½
3¾	41	51	61	71	81	92	102	112	122	142	162	184	204	255	306	357	407	458	509	612	3¾

CARBIDE REAMERS — H. S. STEEL CUTTING RANGE — CARBIDE TIP DRILLS — CARBIDE CUTTERS

Extracted from data published by the Union Twist Drill Co., Athol, Mass.

TABLE OF SURFACE SPEEDS PER MINUTE—2

	← CARBIDE REAMERS →												← CARBIDE CUTTERS →								
	← H. S. STEEL CUTTING RANGE →						← CARBIDE TIP DRILLS →														
Surface Feet Per Minute	40	50	60	70	80	90	100	110	120	140	160	180	200	250	300	350	400	450	500	600	Surface Feet Per Minute
Dia. In.	REVOLUTIONS PER MINUTE																				Dia. In.
4	38	48	57	67	76	86	95	105	114	134	152	172	191	239	286	334	382	430	477	572	4
4½	34	42	51	59	68	76	85	93	102	118	136	152	170	210	270	297	340	382	420	540	4½
5	30	38	46	53	61	69	76	84	92	106	122	138	153	191	229	267	306	344	382	458	5
5½	28	35	42	49	55	62	69	76	83	98	110	124	138	175	208	243	278	313	350	416	5½
6	25	32	38	44	51	57	64	70	76	88	102	114	128	160	191	223	255	286	318	382	6
6½	23	29	35	41	47	53	59	65	70	82	94	106	118	145	176	206	235	264	290	352	6½
7	22	27	33	38	44	49	54	60	65	76	88	98	109	136	164	191	218	246	273	328	7
7½	20.4	25	31	36	41	46	51	56	61	72	82	92	102	125	153	178	204	229	250	306	7½
8	19.1	24	29	33	38	43	48	52	57	66.9	76	86	96	120	143	167	191	215	239	286	8
8½	18	22	27	31	36	40	45	49	54	62	72	80	90	110	135	157	180	202	220	270	8½
9	17	21.2	25	30	34	38	42	47	51	60.1	68	76	85	106	127	149	170	191	212	254	9
9½	16.1	20.1	24	28	32	36	40	44	48	56	64	72	80	100.5	121	141	161	181	201	242	9½
10	15.3	19.1	23	27	31	34	38	42	46	54	62	68	76	95.5	115	130	153	172	191	230	10
11	13.9	17.4	20.8	24	28	31	35	38	41	48	56	62	70	87	104	122	139	156	174	208	11
12	12.7	15.9	19.1	22	25	29	32	35	38	44	50	58	64	79	95	111	127	143	159	190	12
	← H. S. STEEL CUTTING RANGE →						← CARBIDE TIP DRILLS →														
	← CARBIDE REAMERS →												← CARBIDE CUTTERS →								

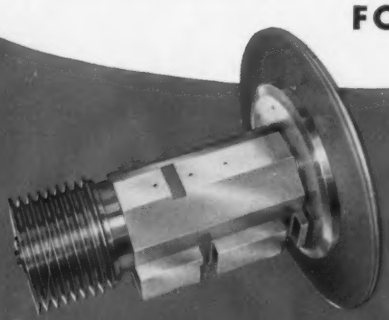
Extracted from data published by the Union Twist Drill Co., Athol, Mass.

There's an EX-CELL-O

Precision Spindle

BUILT ESPECIALLY FOR YOUR WORK

Single-body, belt-driven internal grinding spindle.

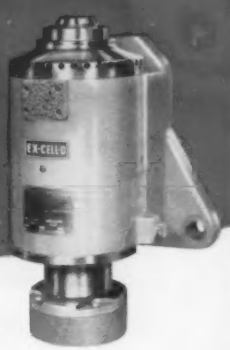


25 hp heavy duty precision spindle with 24" grinding wheel.

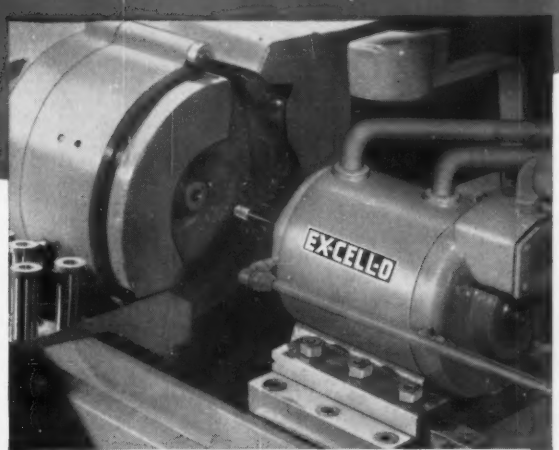
25,000 rpm high frequency inbuilt motor spindle.

Precision inbuilt motor spindle for cutter grinder.

Totally enclosed inbuilt motor surface grinder spindle.



Heavy duty motorized precision spindle available up to 20 hp.



EX-CELL-O High-frequency Spindle, rated at 40,000 rpm, grinds small holes in bushings.

XLO

EX-CELL-O for PRECISION

For production grinding to precision limits "just any spindle" won't do. It must be carefully selected to suit the work. From Ex-Cell-O's widely-varied line of precision spindles you can select a standard model, or we'll make one special to your requirements. These spindles have long been the original equipment choice of leading manufacturers.

Features of the line include:

Rigidity
Permanent adjustment
No vibration, no chatter
Precision ball bearings preloaded for predetermined speeds

Phone your Ex-Cell-O representative, or phone or write Ex-Cell-O in Detroit, for CATALOG LISTING HUNDREDS OF STANDARD GRINDING SPINDLES

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-32

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

Obituaries

John E. Andress

JOHN E. ANDRESS, retired board chairman of Barnes Drill Co., of Rockford, Ill., died on March 26th at the age of seventy-nine years. Mr. Andress was a founder of the Barnes Drill Co. in 1907. He served for many years as secretary, later as president, and was chairman of the board at the time of his retirement eight years ago. Mr. Andress was an active member of the Rockford Chamber of Commerce and the National Machine Tool Builders' Association. His survivors include his widow, a daughter, Lynore E. Bard, and a son, Reed M. Andress, who was formerly president and manager of the Barnes Drill Co.

John E. Andress

ROBERT W. THOMAS, chairman of the board and one-time president of McCrosky Tool Corporation, Meadville, Pa., died March 26 at the age of sixty-five years.

ERVIN S. MUMMERT, president of Mummert-Dixon Co., Hanover, Pa., died on March 11.

ALONZO GALLOWAY DECKER, chairman of the board, president, and one of the founders of the Black & Decker Mfg. Co., died on March 18 at the age of seventy-two years.

ALFRED D. BEEKEN, JR., vice-president of sales, Vulcan Crucible Steel Division, H. K. Porter Co., Inc., Aliquippa, Pa., died unexpectedly on March 26. He had been associated with the company since 1914. Mr. Beeken was a member of the American Iron and Steel Institute and the American Society for Metals. He served as a member of various technical committees for these organizations and was past-chairman of the Pittsburgh chapter of the American Society for Metals.

DR. EUGENE CASSON CRITTENDEN, internationally known scientist and expert on standards of physical measurement, died March 28 at the age of seventy-five years. Dr. Crittenden had retired as associate director of the National Bureau of Standards in 1950, but he continued to serve as consultant to the director up to the time of his illness.

Reviews of Available Motion Pictures

MINING FOR NICKEL

"Mining for Nickel," a forty-five-minute sound-color film on mining operations has been made available by the International Nickel Co. The film, outlines briefly the history of nickel mining in the Sudbury area of Canada and covers in detail the original development of a mine and the six methods of extracting ore employed by Inco.

The picture was produced by Film Graphics, Inc., New York City, in Eastman color. Prints of "Mining for Nickel" are available from the Douglas D. Rothacker, Jr., Organization, 729 Seventh Ave., or the International Nickel Co., Inc., 67 Wall Street, New York City.

TEAMWORK BEHIND PRODUCTION

"Tools of Abundance," a twenty-eight minute all-color sound motion picture (16-millimeter), has been completed by the Wesson Co. The film deals in story form with the basic functions of various members of a typical production team—designers, process engineers, tool engineers, machine operators, purchasing agents, and others.

Interested industrial, professional, and educational groups can borrow the film without cost, upon application to the Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20 (Detroit), Mich.

EXTRUSION PRODUCTION

Aluminum, brass, and steel extrusion processes are described in a 16-millimeter sound-color film that is available from the Lake Erie Engineering Corporation. In the film—"Pressure on Extrusion Production"—loading, sealing, extruding, stripping, and shearing are visualized for the various types of presses. Of special interest are the scenes demonstrating the technique developed by Ugine-Sejournet for the extrusion of hot steel using glass as a lubricant. Specific treatment is given to a patented rotary die-slide mechanism along with the special loading arrangement and also a comparison between long- and short-stroke presses. The twenty-five minute film may be obtained on free loan by writing to the company, Box 68, Kenmore Station, Buffalo 17, N. Y.

Coming Events

MAY 9-11—National Spring Technical Meeting and Welding and Allied Industry Fourth Exhibition of the AMERICAN WELDING SOCIETY will be held at the Memorial Auditorium, Buffalo, N. Y. For further information write to the American Welding Society, Inc., 33 W. 39th St., New York 18, N. Y.

MAY 14-17—First Design Engineering Show will be held at Convention Hall, Philadelphia, Pa. For further information write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 14-17—AMERICAN SOCIETY OF MECHANICAL ENGINEERS sponsors a conference to study industry's problems in design engineering. It will be held at Convention Hall, Philadelphia, concurrently with the First Design Engineering Show. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 17-19—NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—Thirtieth Engineering Industries Exposition in conjunction with its Annual Convention at the Statler Hotel in New York City. For further information write to Harold Becher, chairman of publicity, New York State Society of Professional Engineers, 1941 Grand Central Terminal, New York 17, N. Y.

MAY 17-29—Engineering Industries Exposition, Statler Hotel, New York City. The Consolidated Edison Co. will exhibit a scale model of the reactor which it is constructing at Peekskill, N. Y.

JUNE 11-15—Seventh National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., to be held at the New York City coliseum. Further information can be obtained from the exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York City.

Correction:

EDGAR D. LEON, president of Gear Grinding Machine Co., announces that he and his associates have acquired all of the stock in that company and its subsidiaries, Detroit Bevel Gear Co. and Republic Gear Co., formerly held by Frederick W. Richmond and Leonard Levine. Mr. Leon will operate the companies as president and chief executive officer.

* * *

A General Motors Diesel locomotive unit contains more than 70,000 individual parts.

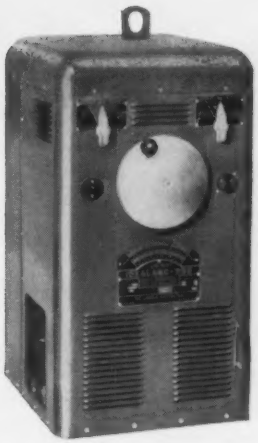
When one welder gives both AC and DC . . .

Handles every type of electrode . . .

Yet costs less to buy and operate . . .

WHY

shouldn't you be using IDEALARCS for your production welding.



IDEALARC . . . *one efficient welder for all your jobs.*
Furnished as an AC/DC welder or as a straight AC welder to which DC can be added at any time.

IDEALARC . . .

industry's most versatile welder

Certain electrodes work best on AC . . . others operate better on DC. Some rods that work best on DC in the smaller sizes work best on AC in the larger sizes. With still other rods, the opposite is true. IDEALARC, with its instant selection of AC or DC, gives optimum performance on every type and size of electrode.

There is no other welder like it

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio

ONE DEPENDABLE SOURCE FOR ALL YOUR WELDING NEEDS

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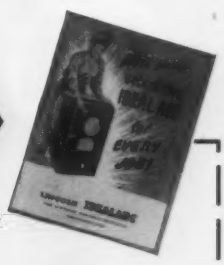

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Name_____

Position_____

For more information fill in page number on Inquiry Card, on page 219

Every Feature Worth a Close, Close Look!

You're Right There! No stretch, no reach, no awkward lifting. Lathe has clean, close front with spindle right under hands.

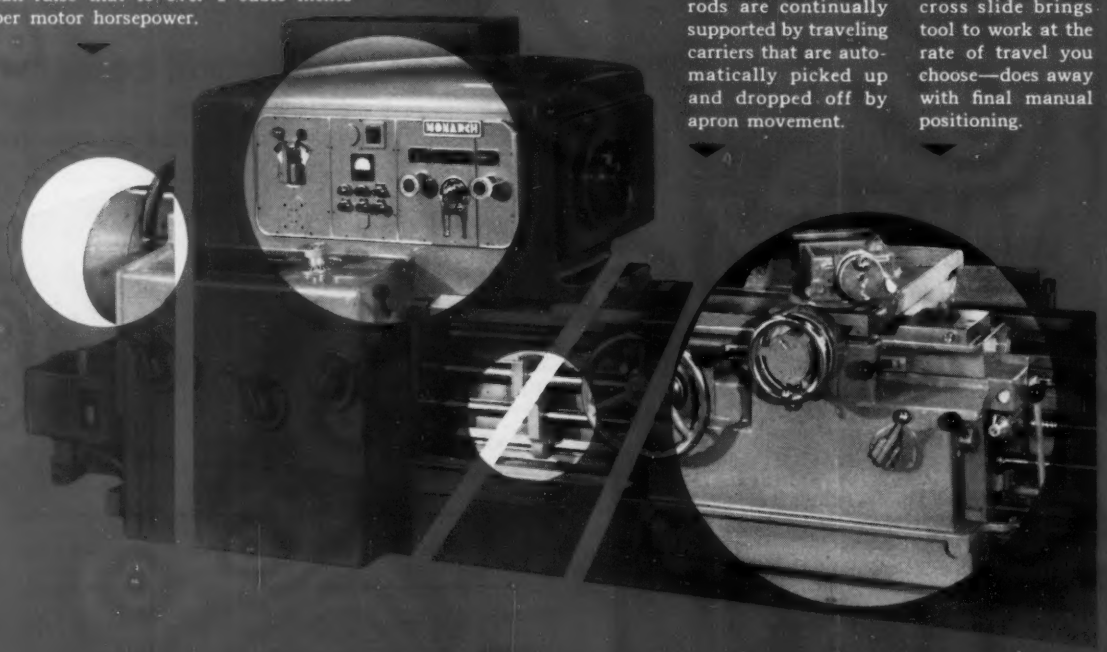
Why Fight Chips? Bedway design provides chutes to empty chips into open pan at rear of lathe. Simple, practical, time-saving.

Headstock With a Brain! Dial work diameter setting and surface cutting speed setting. Dyna-Shift headstock *automatically calculates* required spindle speed and shifts to it hydraulically. No mental gymnastics — no compromise speeds!

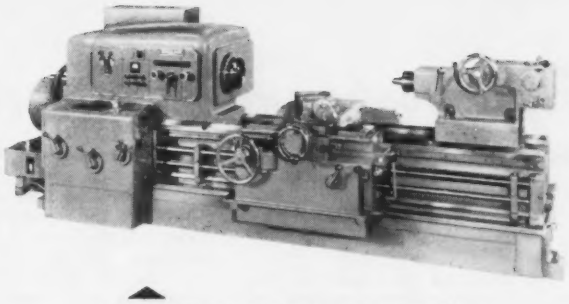
Two for One. When turning medium steel, 1 cubic inch of metal removal per motor horsepower has been considered good performance. On the Series 80 you can raise that to over 2 cubic inches per motor horsepower.

Support Without a Thought. On longer bed lathes, the leadscrew, feed and control rods are continually supported by traveling carriers that are automatically picked up and dropped off by apron movement.

Infinitely Variable — Infinitely Effective. *Variable speed* four-way hydraulic rapid traverse of carriage and cross slide brings tool to work at the rate of travel you choose—does away with final manual positioning.



The Monarch Series 80 DYNA-SHIFT... The New Look in Heavy-Duty Lathes



MONARCH SERIES 80 DYNA-SHIFT LATHE, 36 Spindle Speeds. Headstock Ratio—125 to 1.

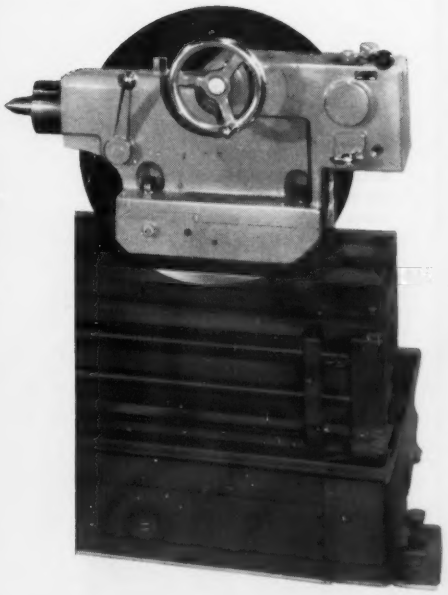
Models 1600 and 1601. Clearance diameter 26″ and 30″. Swing over cross slide 16″ and 20″. Speed Range 10-1250 RPM.

Models 2000 and 2001. Clearance diameter 32″ and 36″. Swing over cross slide 20″ and 24″. Speed range 8-1000 RPM.

Nimble Tailstock. Two speed range spindle movement — *power positioning* provided by engaging plunger on carriage and using longitudinal power rapid traverse.

Here's the lathe that's the talk of the shop and front office alike! The new Monarch Series 80 Dyna-Shift provides a completely new approach to the problem of heavy-duty metal turning —and the results are a rate of metal removal beyond the reach of previous designs; plus added production caused by the many exclusive, new built-in conveniences.

A look at just the few features pictured here tells why. Every one adds to the increased productivity and ease of operation of the machine. And there are so many more that we've prepared a complete, illustrated booklet to tell you about them. For full information on the lathe that gives you ultimate proficiency in the use of carbide tooling on work of considerable size—send for our Booklet #1602 . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**



Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

Clip this coupon to Your Letterhead for Complete Dyna-Shift Booklet

MONARCH MACHINE TOOL COMPANY
Sidney, Ohio

Please send me your illustrated booklet #1602 describing the Series 80 Dyna-Shift Lathe.

NAME_____

TITLE_____

New Books and Publications

MATERIALS HANDBOOK. By George S. Brady. 1,022 pages, 6 by 9 inches. Eighth Edition. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $11.

This handbook gives practical data on approximately 10,000 materials, and pertinent facts on metals, alloys, refractories, abrasives, woods, and many others—all arranged and indexed for quick reference. This latest edition is brought up to date with the inclusion of newer heat-resistant materials and other modern material developments. The book includes patented and trade-named materials to give a more specific understanding of commercial applications. In some cases, the processed materials are discussed because they are the raw materials of many industries.

One of the features is the economic data in Part II. This section presents basic information on the economic geography of materials resources, weights, measurements, and physical comparison of the various materials.

MECHANICAL ENGINEERING PRACTICE. By Charles F. Shoop and George L. Tuve. 471 pages, 6 by 9 inches. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $7.

Measurement of technical and economic performance of machines and equipment is presented and attention is called to the precise requirements of codes and standards sponsored by various professional groups.

Recent trends, such as the greater use of electrical instruments and transducers and the study of dynamics, and the processes of flow and heat transfer are reflected. Much new material is included in each chapter, and special emphasis is placed on new techniques for mechanical measurements, dynamic characteristics of processes, and automatic control. This book serves as laboratory text-book, as well as a reference book for the engineer engaged in industrial work.

THEORY AND PRACTICE OF LUBRICATION FOR ENGINEERS. By Dudley D. Fuller. 432 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $10.50.

The book presents a solid foundation in theory of lubrication, and applies principles to a wide range of lubrication problems. Numerous examples are worked out in discussions of problems. Many bearing designs are given including among others those for machine tools, turbines, large motors, rolling mills, ball mills, and centrifuges.

Direct references are made to outstanding examples of recent research in lubrication. The techniques used and results achieved are included in the discussions. The book offers a complete treatment of hydrodynamic theory with emphasis on the engineer's point of view.

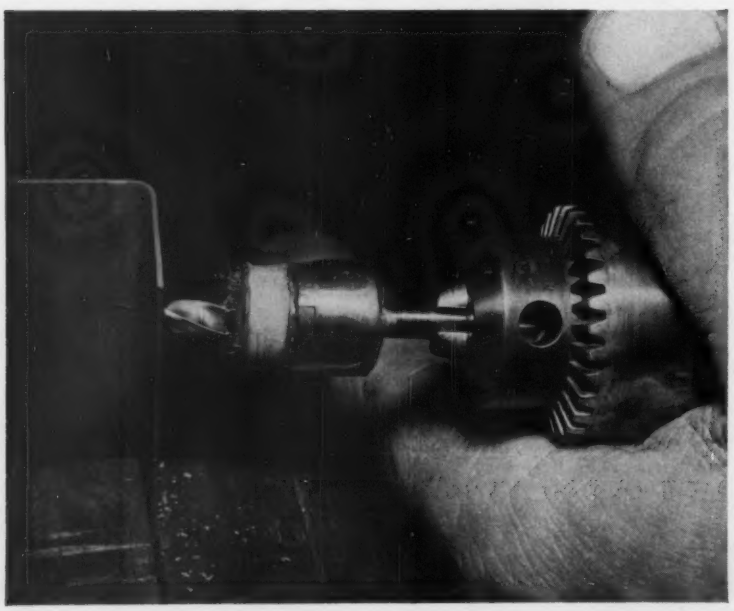
MACHINE DESIGN. By Joseph Edward Shigley. 418 pages, 6 by 9 inches, 442 illustrations. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $6.50.

In this latest addition to the McGraw-Hill Series in Mechanical Engineering, the author has attempted not only to present an unusually scientific treatment of the subject but also to broaden the scope of machine design, as usually presented, by developing the relations between the design specifications and the method of analysis or synthesis used in the solution.

Unusual attention is also given throughout to developing the latent creative ability of the reader. This is accomplished by emphasizing synthesis and by requiring the reader to make decisions and assumptions and to choose the method of analysis, in solving the problems.

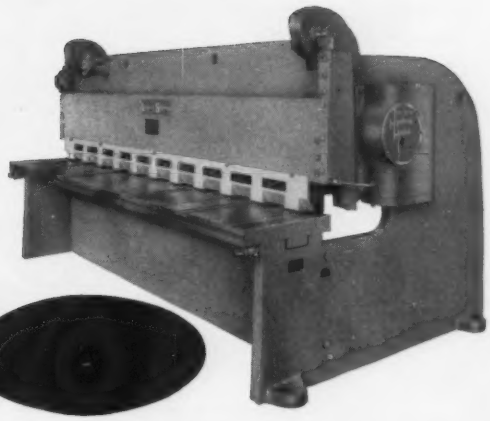
Part I constitutes a study of the design of fundamental machine members, such as shafts and machine frames; develops the basic design factors used in making engineering decisions such as stress, displacement, and heat; and defines important concepts used in machine design, such as factor of safety. Part II applies the principles developed in Part I to the study of various design approaches.

Two types of problems are included. The pure practice problems will ground the reader in the methods of analysis being studied; they require no decisions and usually have only one answer. The true design problems permit a choice and require that decisions be made in order to obtain a solution.



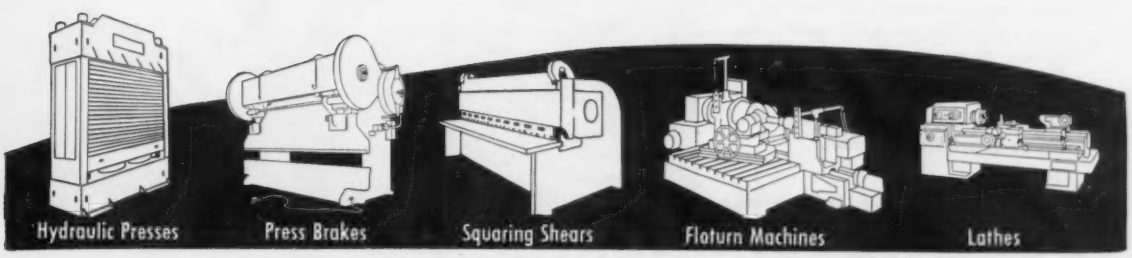
A tool which drills holes and removes cladding from aluminum alloys in one operation has been developed at the Glenn L. Martin Co., Baltimore, Md. Removal of the coating of pure aluminum permits positive electrical connections to be made to aircraft structures. The tool consists of a drill attached to a standard wire brush.

keep your
shear operators in the
production zone



WITH A LODGE & SHIPLEY POWER SQUARING SHEAR

There's one thing for sure about shearing.
Keep the operator out front for maximum production!
That's why one user calls the space in front of his Lodge & Shipley Shear the "Production Zone." With all adjustments in front and all clear behind the shear, the operator stays out front and on top of the shearing job. Necessary adjustments can be made quickly . . . scrap or cut pieces can be removed from the back of the shear by hand, truck or even conveyor.
There are, of course, many other productioneered features in the New Lodge & Shipley Shears. For details, write for Bulletin PS-8:
The Lodge & Shipley Co., 3057 Colerain Ave., Cincinnati 25, Ohio



For more information fill in page number on Inquiry Card, on page 219

Manifold Supplies Air to Four Portable Tools

Stand-mounted manifold that is fed from a single hose provides four compressed-air connections

A simple manifold constructed of pipe by engineers at Anniston Ordnance Depot, Anniston, Ala., provides four outlets from one hose connection to the shop compressed-air line. This stand-mounted manifold, here shown, can be constructed in a few hours to provide air outlets for portable tools when simultaneous usage at one location is necessary.

Previously, two compressed-air outlets were located on the plant floor at 25-foot intervals. Workmen often found it necessary to use several air tools on one job at the same time. This necessitated either using 25-foot hose connections to the nearest air outlet or changing tools.

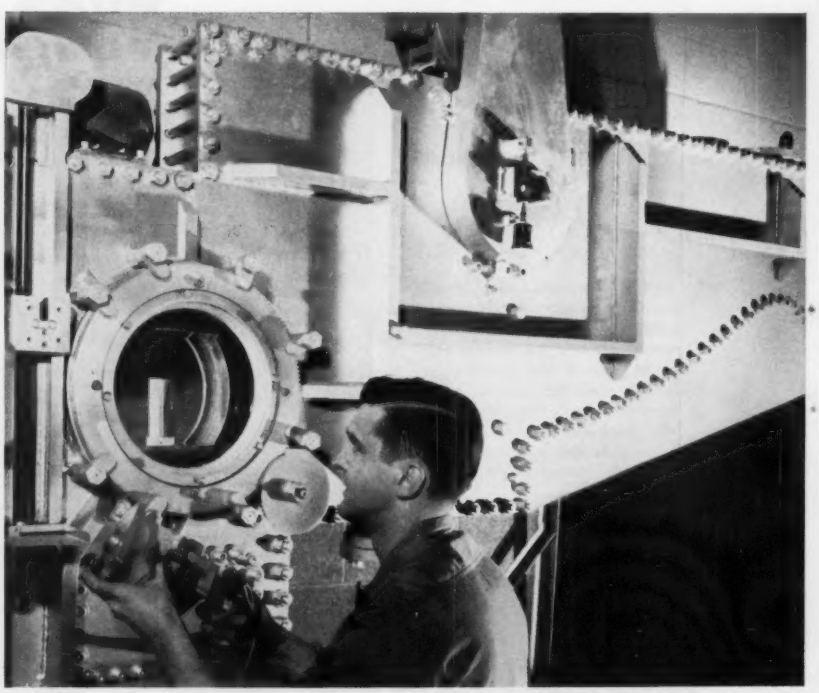
This manifold is constructed of 4-inch steel piping, with a welded seal on each end. Four control valves are fitted into the 3-foot long pipe. Standard hose couplings make connection of tool lines a simple operation. Air at a pressure of 100 to 125 pounds per square inch is brought into the manifold by a hose connected directly to the compressed-air line. Minor discharge pulsations are reduced in the manifold.

Supersonic Wind Tunnel Tests Jet-Engine Components

A supersonic wind tunnel has been installed at the General Electric Co.'s Development Department Laboratory at Evendale, Ohio, to test jet-engine components at many times the speed of sound.

A technician is shown adjusting the equipment, with a jet-engine blade model already positioned in the windowed throat of the test section. The two windows on opposite sides of the test model permit special high-speed photographs to be taken to study aerodynamics phenomena.

Air rushes through the tunnel at over 1800 miles per hour. It can also operate at up to 400 degrees F. at 120 pounds per square inch maximum tunnel inlet operating conditions, as well as at low-pressure conditions simulating altitude.



Jet-engine blade model being tested in supersonic wind tunnel

Complete BROACH TOOLING for Customer's Machines

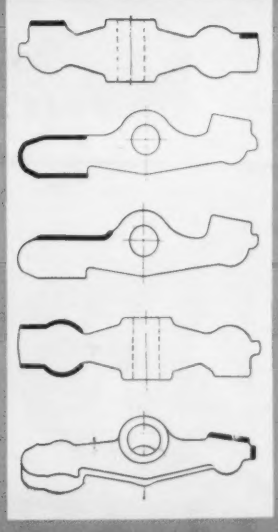
CONTINENTAL CAN RETOOL YOUR PRESENT BROACHING EQUIPMENT FOR HIGH PRODUCTION AND INTERCHANGEABILITY, AT MINIMUM COST

These forged steel rocker arms are economically processed with Continental designed and built broaches, holders and fixtures. The work is done in five operations on two vertical surface broaching machines, one having a single ram and the other a dual ram.

More and more manufacturers are turning to broaching for machining production parts. It's the fastest method of removing stock to precision limits. For a quotation on tooling for your broaching machines call in your local Ex-Cell-O Representative or contact the Continental Division of Ex-Cell-O in Detroit.

Here is the fixture and broach tooling for the first operation.

THE HEAVY LINES INDICATE THE METAL REMOVED IN EACH OF THE 5 OPERATIONS

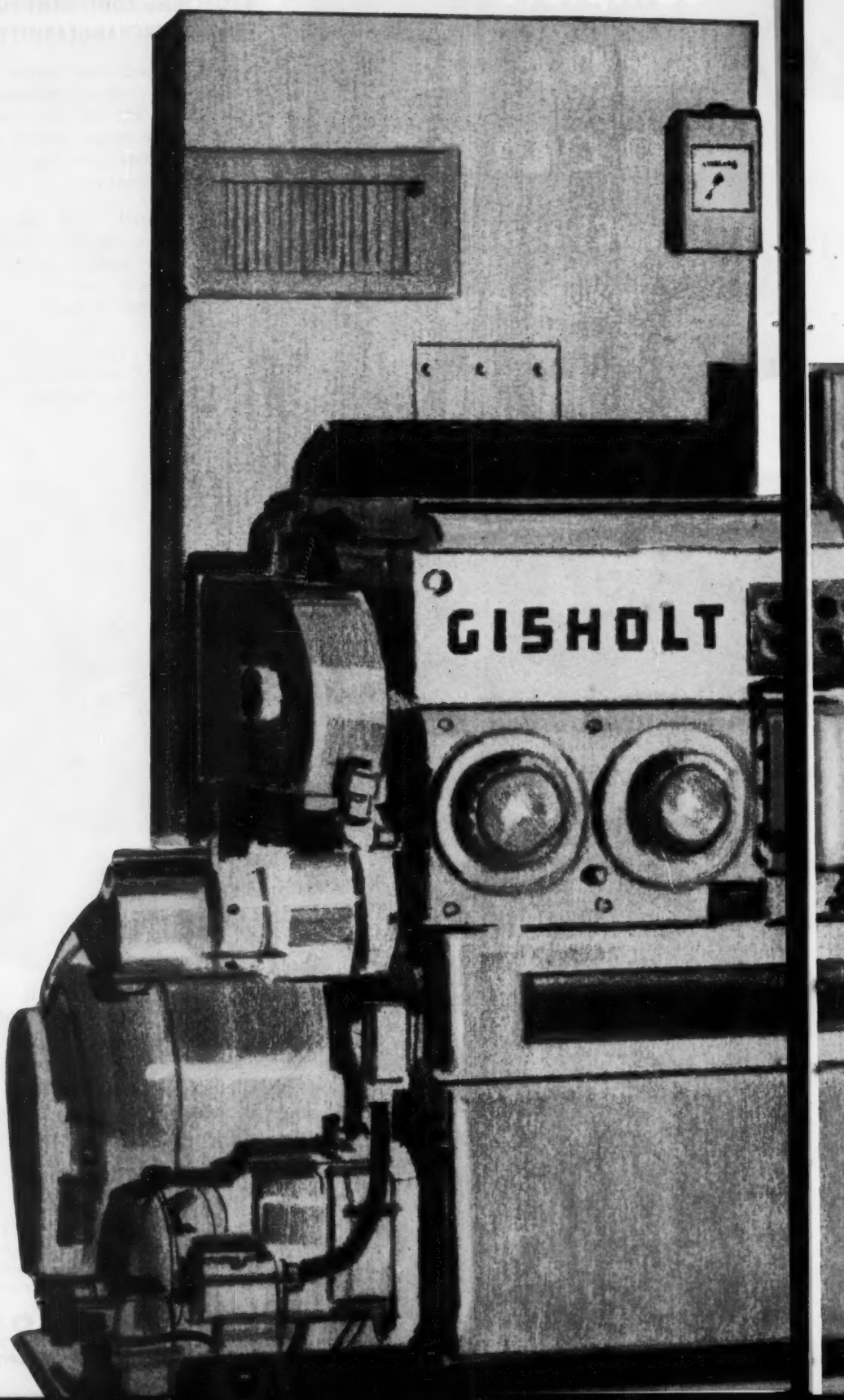


OPERATION 1: Finish broach thrust face and broach locating surface at opposite end. Operation is done on single-ram vertical surface broach machine. Work is located in fixture on floating pin, which allows part to rest firmly on lower anvils when clamped. Spring loaded jacks are wedge locked automatically. Broaches for both cuts are carried in one holder. The only change necessary to accommodate opposite hand parts is to exchange adapters on the fixture.

Continental CTW TOOL WORKS

Division of EX-CELL-O Corporation, Detroit 32, Mich.

55-30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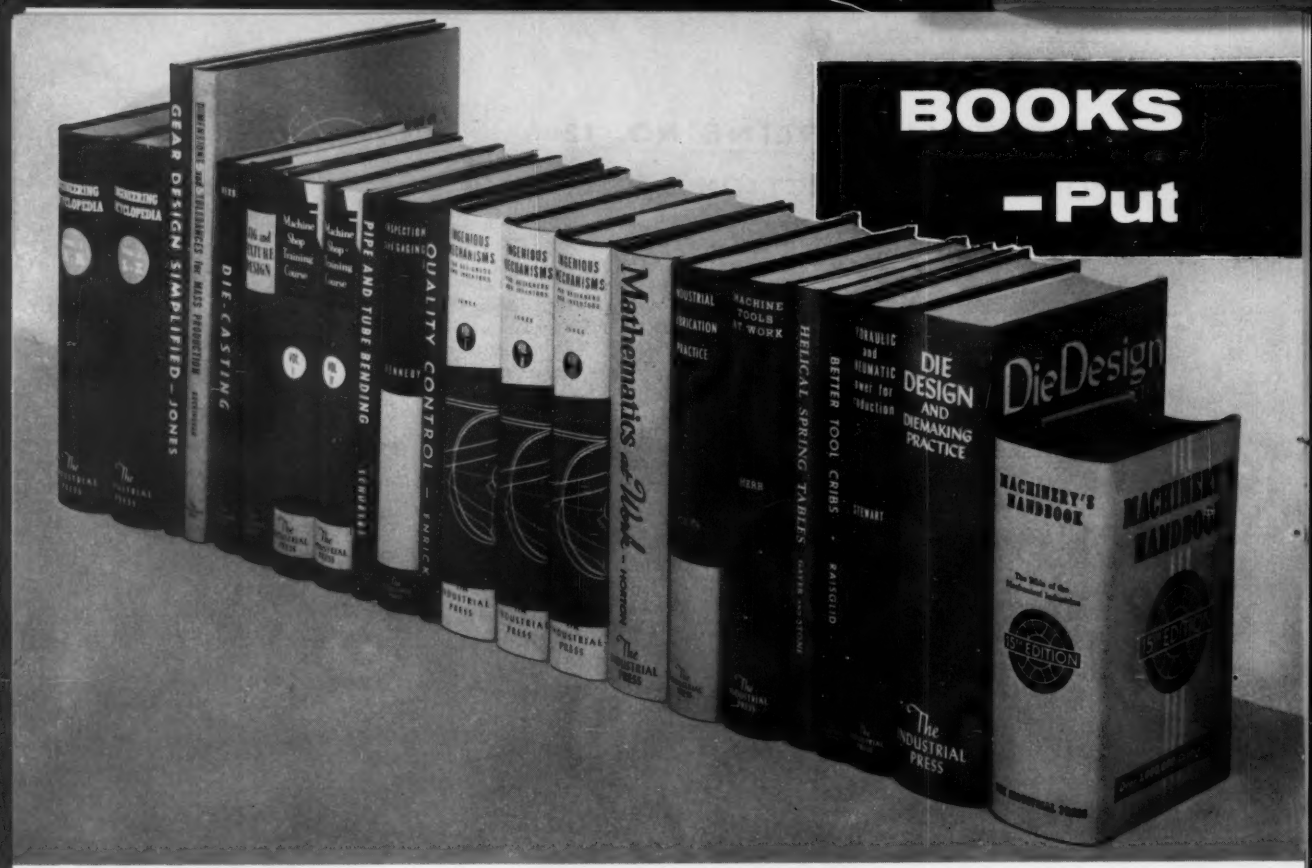

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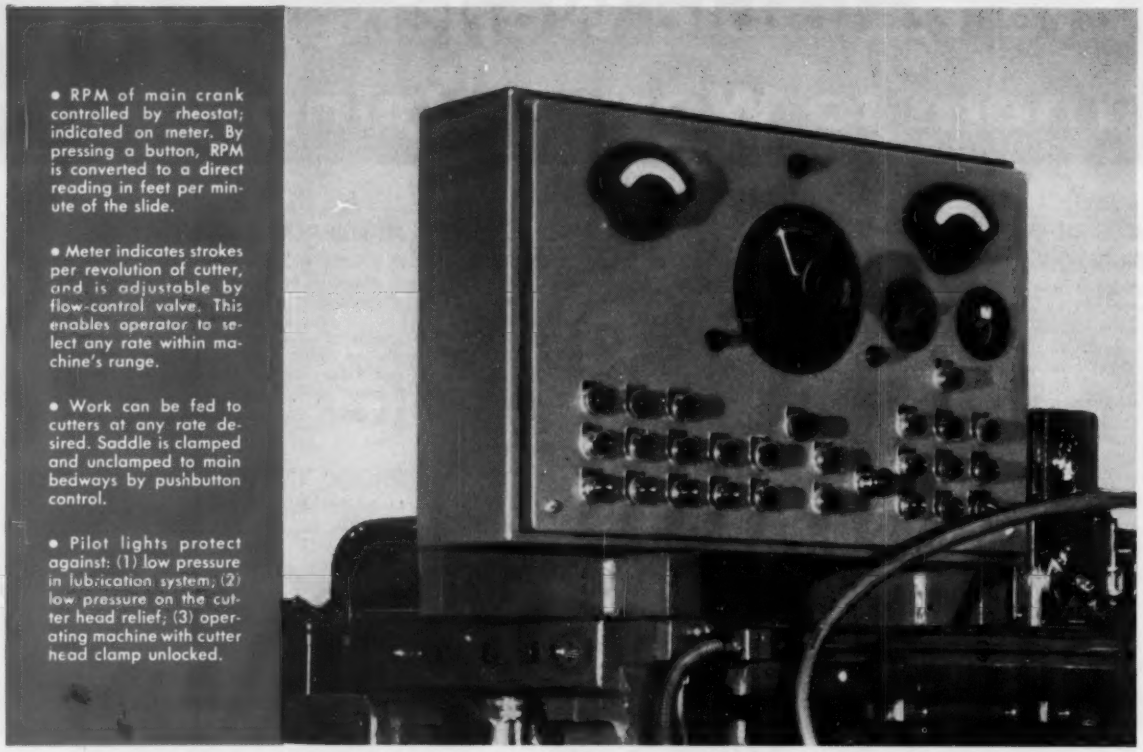

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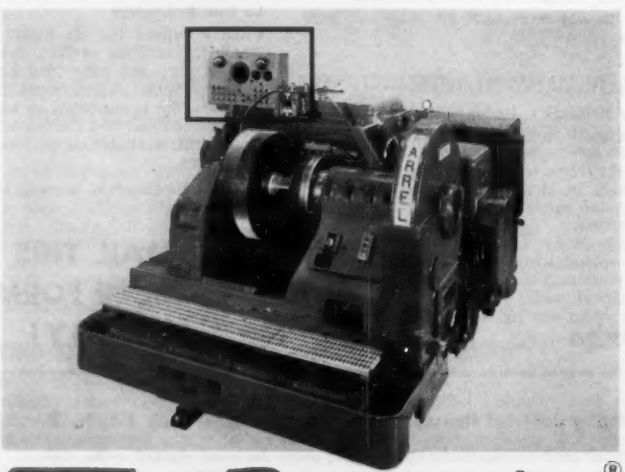

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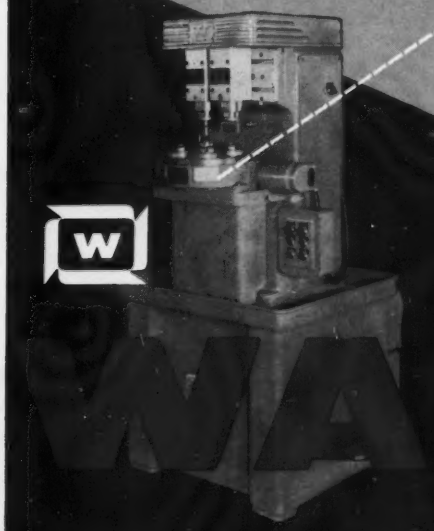

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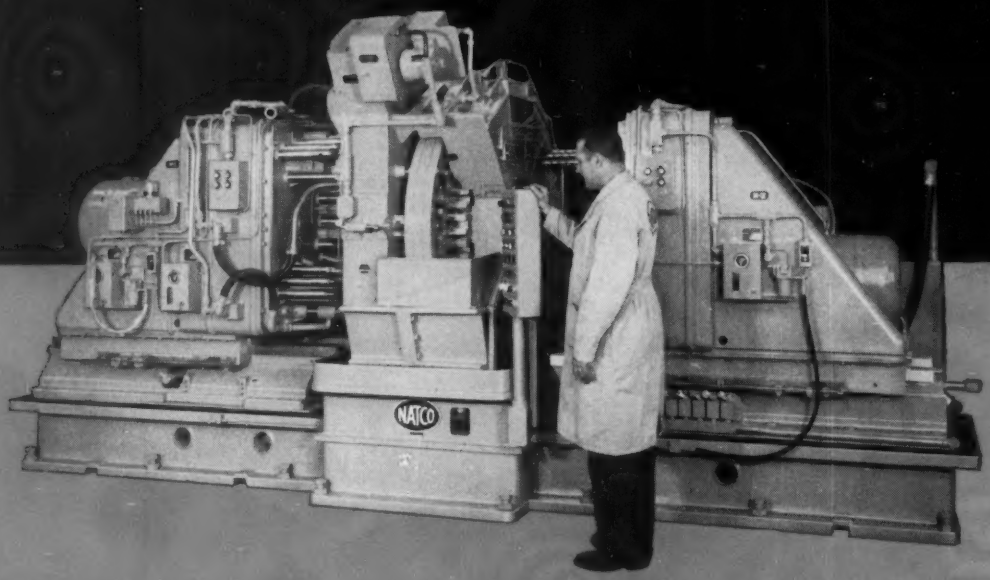

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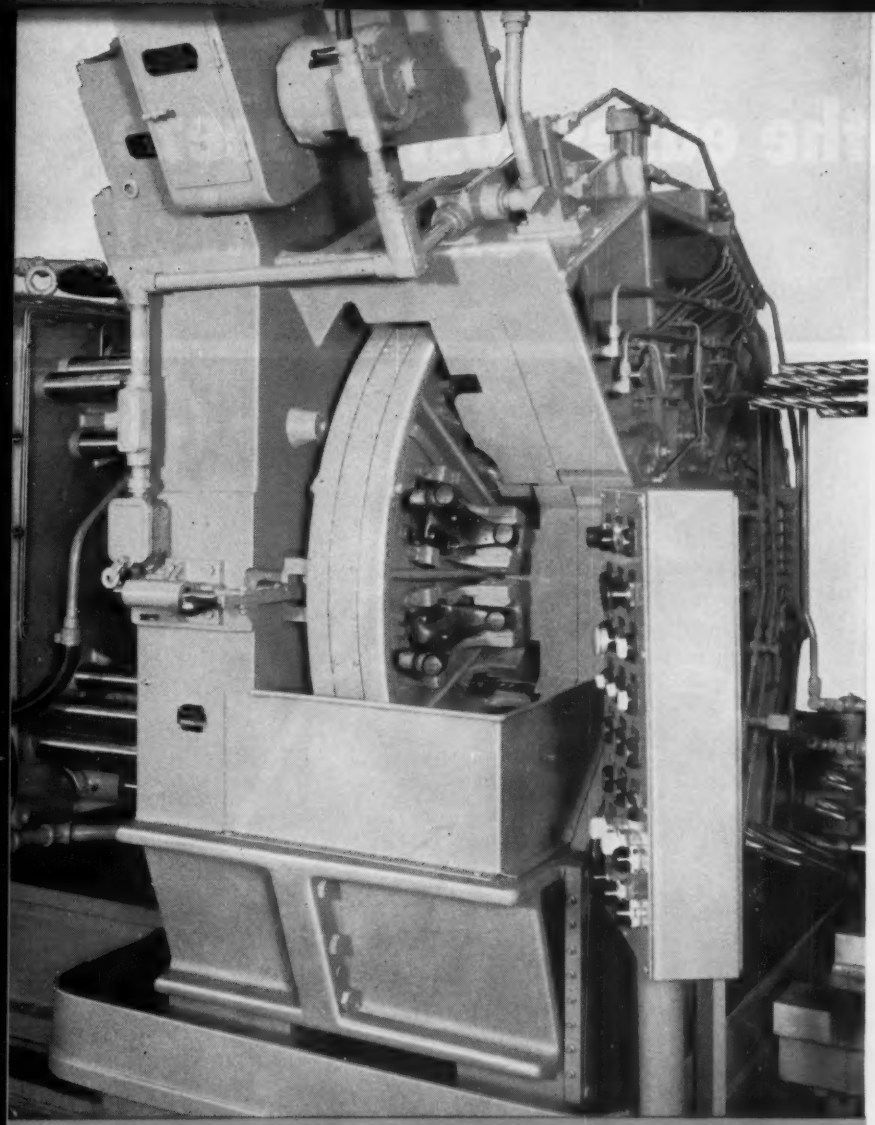

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Whole Hog or Piecemeal

Seems like two distinct approaches are being taken in the adoption of automatic assembly methods. The "whole hog" school favors abrupt change . . . wait until you can install a machine that will handle the *complete* assembly job. The "piecemeal" school favors a step-by-step transition, starting with the basic transfer mechanism and adding automatic stations one or two at a time.

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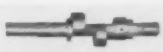
Processed by Natco Machines

Part: Gear Housing
Machine: Natco vertical Holesteel
Operations: Drill 11 holes; Counterbore 1 hole; Chamfer 3 holes; End cut ream 1 hole; Combination ream, face and chamfer 1 hole; Ream 3 holes.
Production: 90 per hour

Part: Cylinder Block
Machine: Natco Holesteel
Operations: Drill 17 holes in 4-cylinder block or 23 holes in 6-cylinder block.
Production: 40 parts per hour



Part: Shaft
Machine: Natco H-5
Operations: Combination drill and chamfer 3 holes; Drill 4 holes.
Production: 80 parts per hour

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Richmond, Indiana

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Special machines for automatic production

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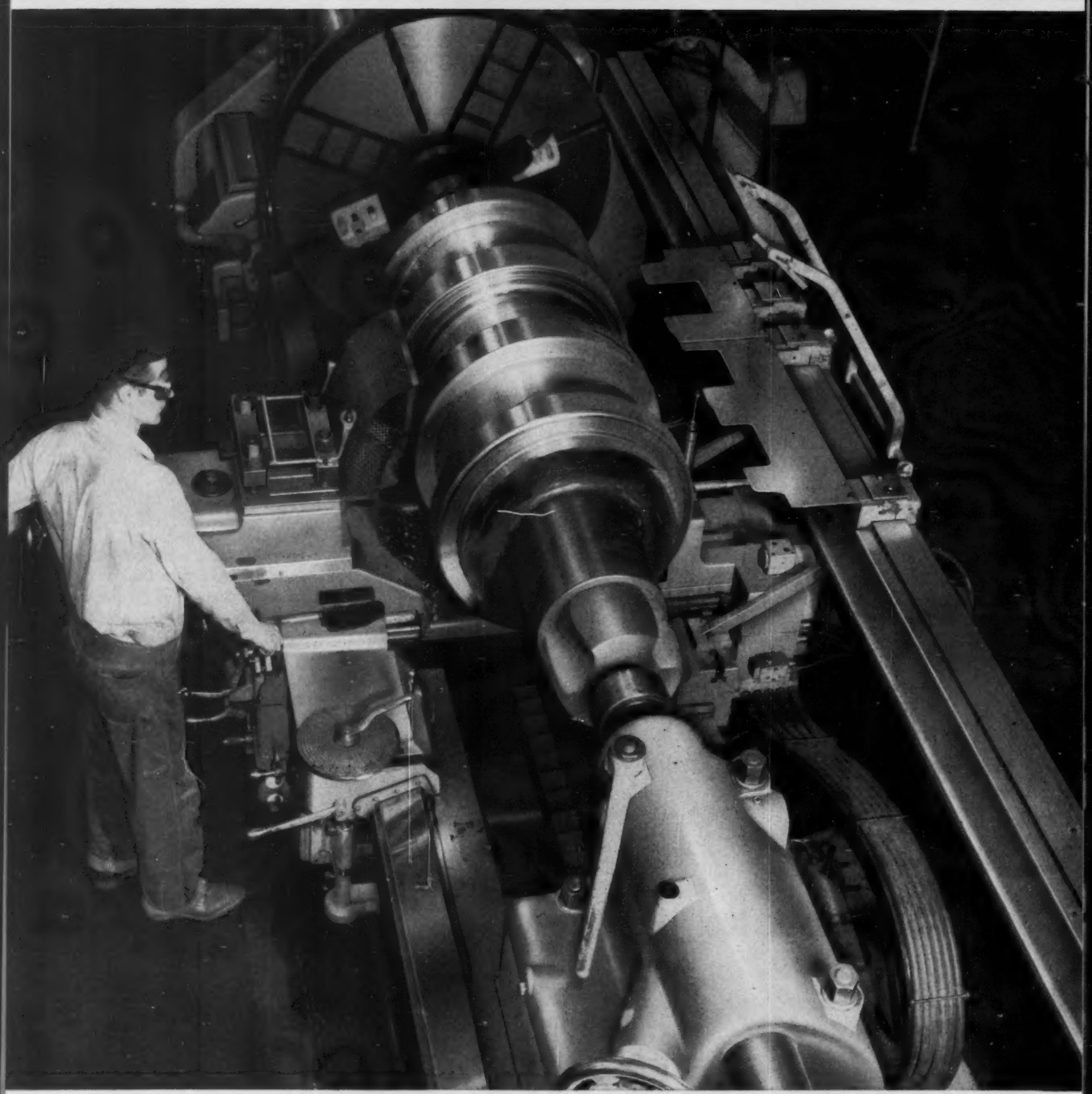
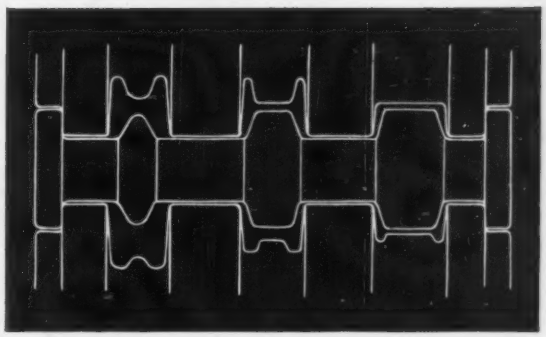
LeBlond Lathe eases cost squeeze ...on rolls that



A set of Shape rolls of 30½" dia. x 51" body cast alloy semi-steel are turned to .005" tolerance in 94 hours on this 50" LeBlond Roll Contouring Lathe. Set-up time—¼ hour. Clamped-on and brazed-on carbide tips are used at 48 rpm, .040 ipr feed. Conventional roll lathe took 245 hours for the same set of rolls.

squeeze channels from blooms

U. S. Steel Lops 151 Hours Off 245-Hour Roll-Turning Job.



Typical roughing rolls for 8" channel

Every day at U. S. Steel's Clairton Works, Clairton, Pa., miles of "hotter-than-orange" steel are squeezed through the passes of rolls like these for reduction, elongation, shaping. They come out as finished structural steel for the "jungle-gym" frameworks of modern buildings. Turning these costly shape rolls with their steep-angle contours used to keep a lathe running *245 hours on a set of roughing rolls* at U. S. Steel. Tool life was short and the job required highly skilled operators. Stepped-up schedules called for a new solution to this tough-nut production problem.

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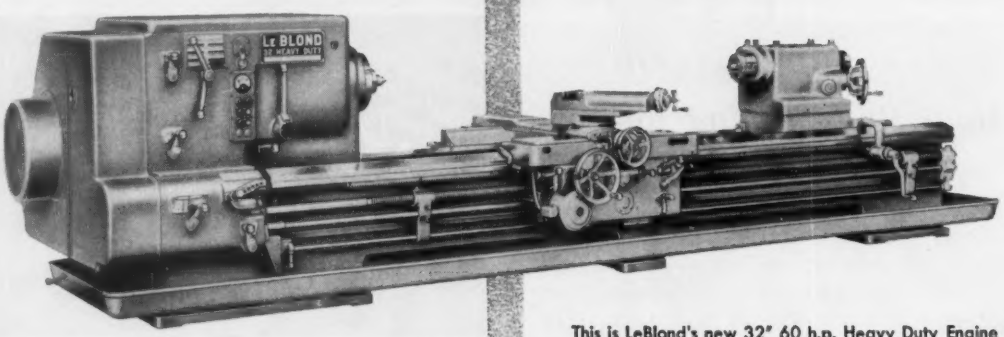

Photo courtesy LeBlond of Cincinnati

This is LeBlond's new 32" 60 h.p. Heavy Duty Engine Lathe. 36 speeds from 4.5 to 500 r.p.m. Adjustable acceleration to bring heavy workpiece up to speed safely. For complete details, write the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. Ask for Bulletin HD-165.

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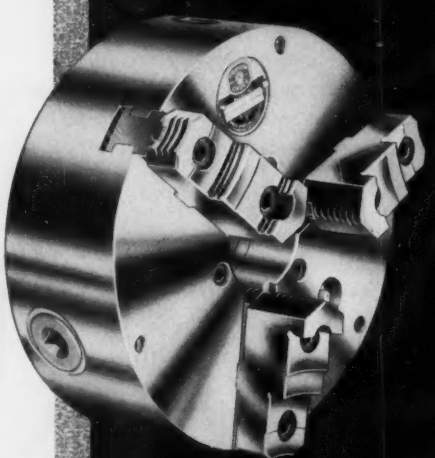

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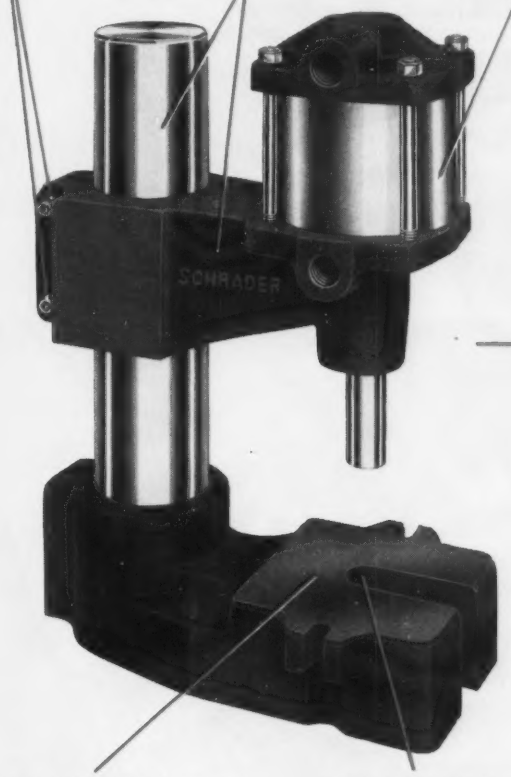

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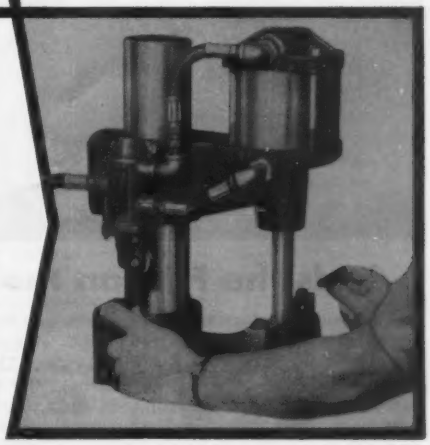

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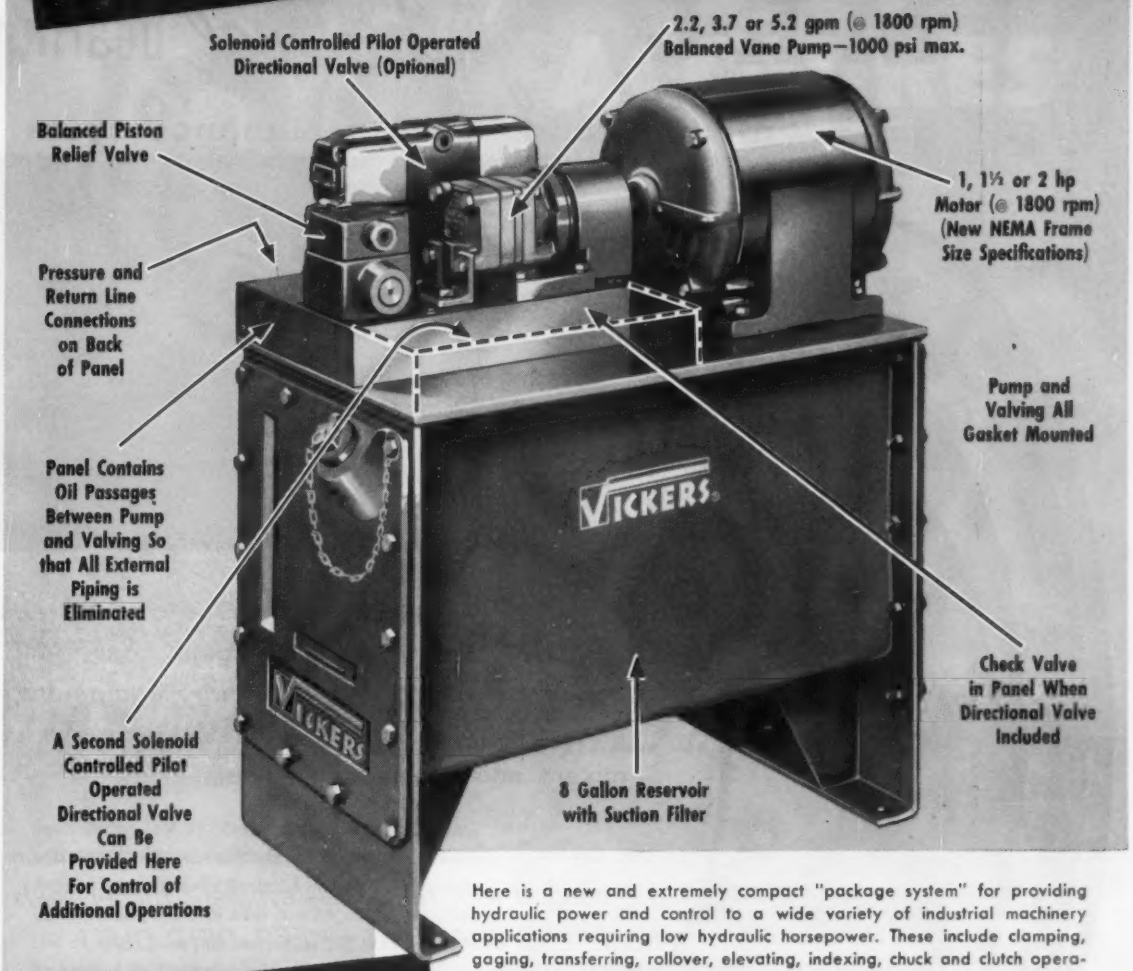
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has cut manufacturing and maintenance costs

Application of M-R-C *"Synthe-Seal"* Ball Bearings in electric motor. One of hundreds of applications in machine tools, coal mining machinery, home laundry equipment, hand tools, lawn mowers, water pumps, mixers and automobile wheels.

The M-R-C "Synthe-Seal" is a standard dimension ball bearing with removable synthetic rubber seals– KEEP LUBRICANT IN—KEEP DIRT OUT!

WRITE FOR FORM 1528

M-R-C Engineers are available for consultation on your bearing problems.

M-R-C Strom SRB GURNEY BALL BEARINGS

MARLIN ROCKWELL CORPORATION

Executive Offices: JAMESTOWN, NEW YORK

TO PROVIDE A SOURCE FOR KELLY REPLACEMENT PARTS

Davis Boring Tool Division, long the outstanding name in tooling, now further extends its leadership in service! Acquisition of the Kelly Reamer Company of Cleveland, Ohio, permits Davis to offer a more complete cutting tool service. Sales and service for the Kelly line will be handled by the nation-wide network of Davis representatives and field tool engineers. Individual identity of the Kelly line will be maintained, assuring users ready replacement parts for Kelly equipment now in use. Make Davis your "tooling headquarters," secure in the knowledge that you will continue to receive equipment built to Davis standards of precision, productivity and unrivalled quality.

DAVIS BUYS KELLY'S TOOLING SERVICE, AND NOW OFFERS ITS COMPLETE TOOL LINE AND REPLACEMENT PARTS THROUGH A NATION-WIDE GROUP OF DAVIS REPRESENTATIVES

PLEASE SEND NAME OF DAVIS REPRESENTATIVE WHO WILL SERVE MY NEEDS IN THE KELLY REAMER LINE

NAME

TITLE

COMPANY

ADDRESS

CITY

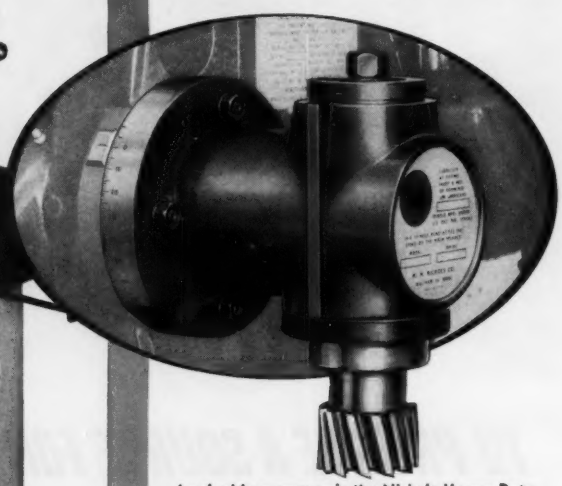
ZONE STATE

M

DAVIS
BORING TOOL DIVISION
Giddings & Lewis Machine Tool Company · Fond du Lac, Wisconsin

THE *Nichols* TOOL ROOM MILLER

"the miller that uses its head!"



A valuable accessory is the Nichols Heavy-Duty Vertical Milling Attachment. Takes full 1½ H. P. up to 2000 R. P. M. (So precise, some shops use it for jig boring!)

ASTE Show
Chicago, Booth 351

The unusual versatility and extra capacity of this model make it extremely useful for the tool room. Because it is equipped with the "rise-and-fall" spindle, it can perform not only conventional precision milling, but also facing boring, key seating, contour milling and other operations. Both longitudinal and transverse feed screws are fitted with hand wheels and extra-large adjustable micrometer dials with easy-to-read graduations. This model is especially useful because of its compactness, generous capacity and ability to handle a wide variety of work to close tolerances —*to "tenths" when desired!*

CONDENSED SPECIFICATIONS

Table Working Surface	8½" x 30"
Longitudinal Travel	19"
Transverse Travel	7"
Vertical Travel—Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R. P. M.	
Weight	1250 lbs.

Write today for Nichols general catalog which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY • WALTHAM, MASSACHUSETTS

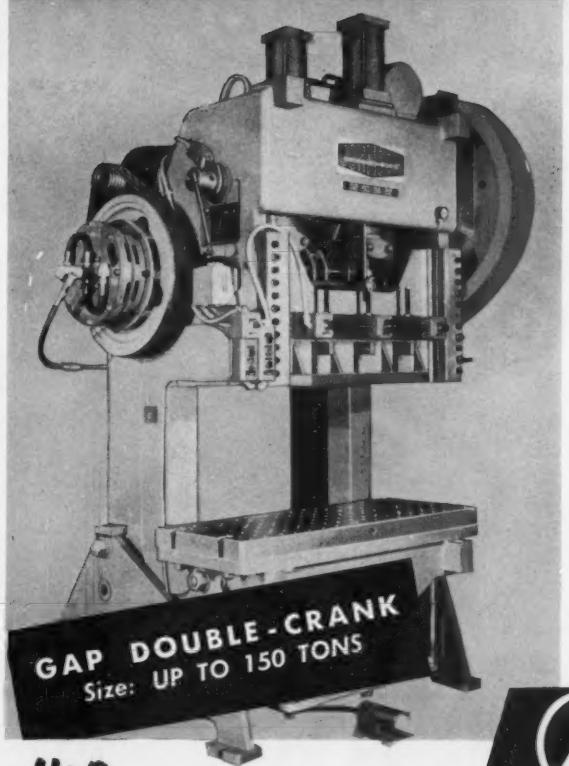
NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-E MAMARONECK AVE.
WHITE PLAINS, N. Y.

JOHNSON

INTRODUCES

TWO NEW SERIES of PRESSES



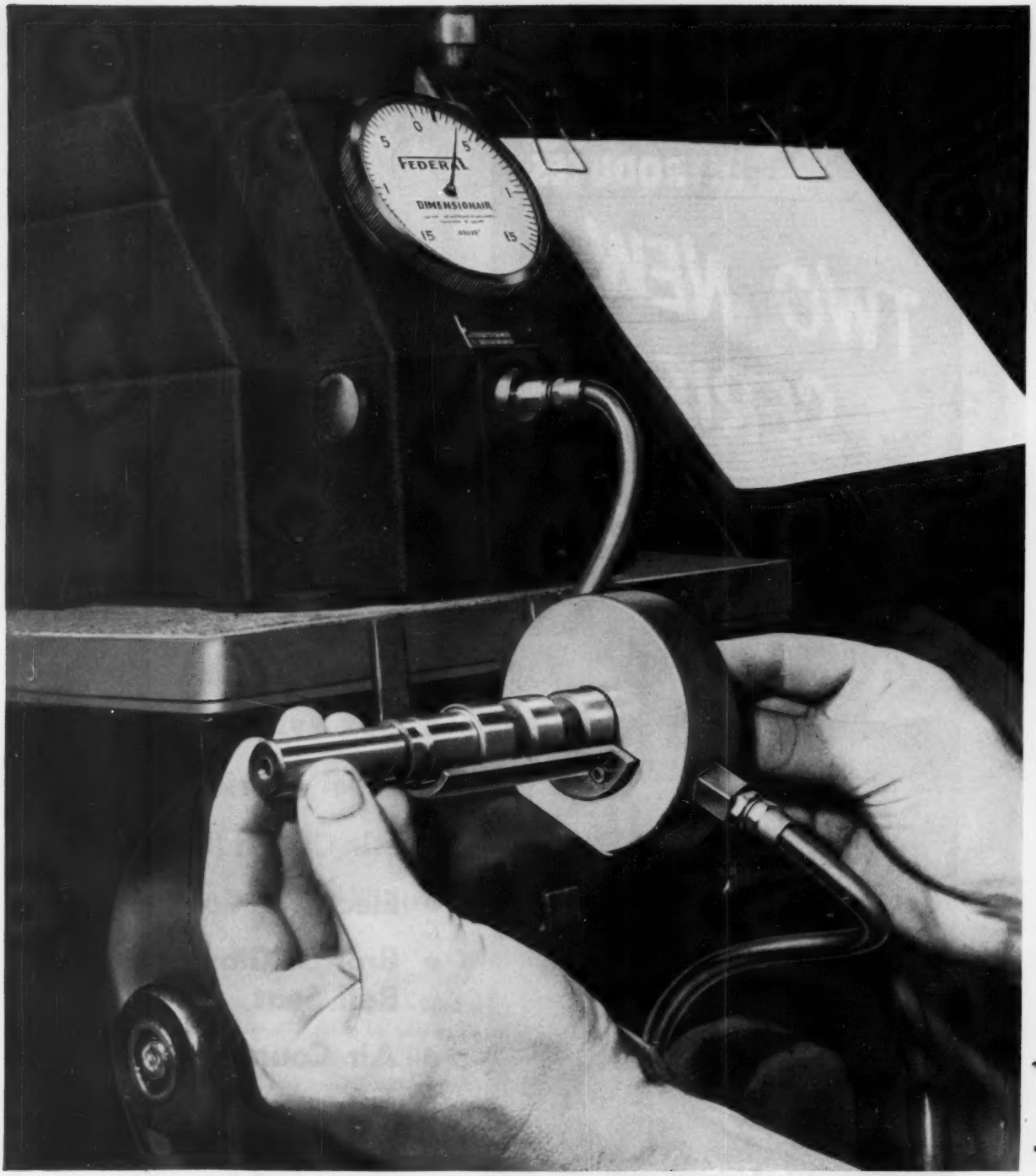
- **Box Type Ram**
- **Steel Fabricated**
- **Air Clutch (low inertia)**
- **Electrical Controls**
- **Bronze Gibs and Ball Seat**
- **Air Counter Balance**

Write for Bulletin 1956

***Also** 22 MODELS OF OBI MECHANICAL PRESSES from 16 to 125 Tons Capacity*

Johnson MACHINE and PRESS CORP.

620 WEST INDIANA AVENUE • ELKHART, INDIANA



Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Find out the facts about Dimensional Air Gages Do it yourself – it's easy!

There's a lot of confusing talk today about the merits of various air gages. With so many conflicting claims, it's difficult to learn the true facts. Each manufacturer of air gages naturally claims his is superior. So how are you going to determine which, in the long run, is the best for you to buy?

Find out the facts for yourself. You don't have to accept any gage manufacturer's claims. We invite you to let us put a Dimensionair right in your own shop so that all personnel involved can operate and compare it, feature by feature, with any other air gage on the market.

Forget all about sales pitches and competitive arguments. You make the decision yourself. After comparing the Dimensionair with the air gages now in your plant, or directly in competition with any other air gages, make your decision entirely on the basis of your own actual tests and comparisons. *You* be the judge!

FIND OUT WHICH IS THE BEST AIR GAGE FOR YOUR PLANT. SEND US THIS COUPON:

Federal's Solution to the Cost of Gaging . . .
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Federal Products Corporation
6115 Eddy Street, Providence 1, R. I.

We'd like to test a Dimensionair in our plant.

Company name.....

Your name..... *Title*.....

Address.....

.....

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Macklin Co., 2925 Wildwood Ave., Jackson Mich.

no one has ever paid for service
There's never been a charge . . . never . . . for factory service on a Fulmer Honing Machine! And Fulmer Service is far more than an empty phrase. A company airplane is maintained to deliver service personnel and replacement parts, often in a matter of hours to meet an emergency. Fulmer machines offer the following added advantages:
FASTER . . . EASIER . . . MORE ECONOMICAL PRECISION-HONING OF INTERNAL BORES
. . . for FULMER HONING MACHINES
FULMER
Amazingly fast . . . stock removals up to 1½ cu. in. per minute; geometrically accurate . . . surface finishes down to one micro inch, rms . . . identical finish from hole to hole . . . generous overload capacity, etc.
Fulmer precision honing machines can do for you what they are doing all over the world — save time and money! Write for Bulletin on Honing to: C. Allen Fulmer Co., Dept. "M" 107 E. 4th St., Cincinnati 2, O.
FULMER honing equipment

Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Bridgeport Brass Co., Bridgeport, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
International Nickel Co., 67 Wall St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

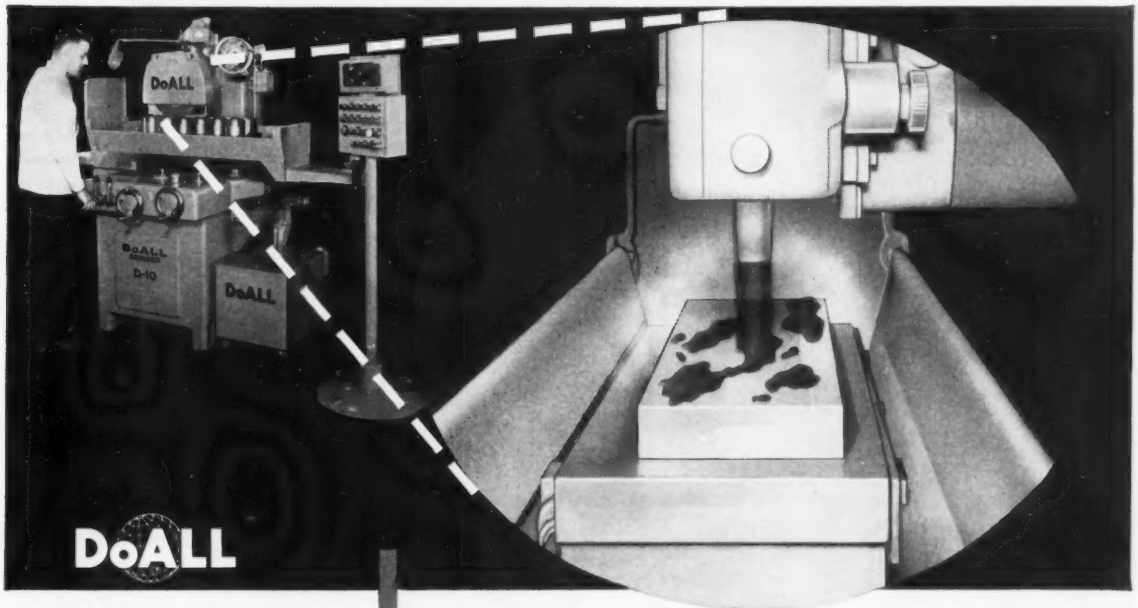
ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

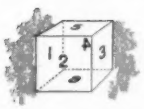
ARBORS AND MANDRELS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
Le Count Tool Works, Inc., 390-L Capitol Ave., Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 272)

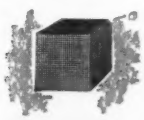
"Cool Grinding" Proves 1000 Times More Effective than Flood Cooling



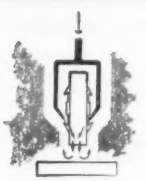
Mist Provides 1000 Times More Heat Absorbing Surface



A cubic inch of coolant offers six square inches of heat absorbing surface.



Atomized, each of the 1,000,000,000 cubes offers .000006 square inches of surface or total of 6,000 square inches over all.



In "COOL GRINDING" coolant is fed to the sides of the wheel. Centrifugal pump action draws the coolant into and through the wheel. It emerges atomized, right at cutting edge.

Grind Faster, Grind Accurately, More Confidently

Atomized coolant, as shown at left, is 1000 times more effective as a heat absorbent than liquid coolant. "Cool Grinding" puts this atomized coolant directly at the point of work-wheel contact. Temperatures are reduced as much as 1300°F as compared to flood cooling.

Aids Precision in Grinding—Efficient heat dissipation prevents expansion—helps assure close control of dimension and parallelism.

Ground Parts Last Longer—"Cool Grinding" eliminates burning, checking and stresses—a source of premature failure of ground parts resulting from high heats and quick quenching.

Increased Production—Grinding can be done at faster rates, without heat expansion or damage.

Dry Grinding Visibility—Mist does not obscure work, visibility is unlimited.

Wheel Life Increased—Continuous flushing and cooling action *in* the wheel greatly increases its life.

Standard Grinding Wheels—No need for wheels with "special" arbor holes.

Coolant Recirculates—Saves on coolant. Special filter cleans the coolant before reuse.

Free In-Your-Plant Demonstration—DoALL will bring a grinder to your plant and show you how to increase your grinding profits. Write: **The DoALL Company, Des Plaines, Illinois**

FREE MOVIES—Sound and color to show you the ultimate in precision grinding. Call DoALL locally or write.

FREE CATALOG—Shows design and construction of DoALL Grinders and accessories including "Cool Grinding".

Friendly DoALL Sales-Service Stores In 38 Cities.

Cool Grinding U.S. Pat. No. 2470350

GR-17

A call to any one of our seven warehouses will get you speedy service on your order . . . whether it's for *alloy steel bars, billets or forgings,* in any size, shape or treatment you need.

All seven warehouses are located in principal industrial areas. Each is modern and well-stocked, and staffed by expert metallurgists.

Call now if you need our own HY-TEN steels – "the standard steels of tomorrow", or standard AISI or SAE grades.

Or write for *free* copies of Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

In Canada: Sanderson-Newbould, Ltd., Montreal and Toronto

WHEELOCK, LOVEJOY & COMPANY, INC.

138 Sidney Street, Cambridge 39, Massachusetts

BABBITT

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Shenango-Penn Mold Co., Dover, Ohio

BARS, Steel

Allegheney Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio

BEARINGS, BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves.. Toledo, Ohio.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio

BEARINGS, Lineshaft

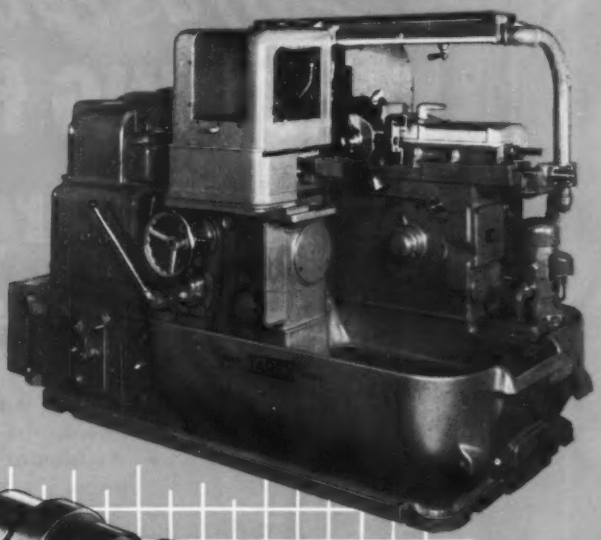
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

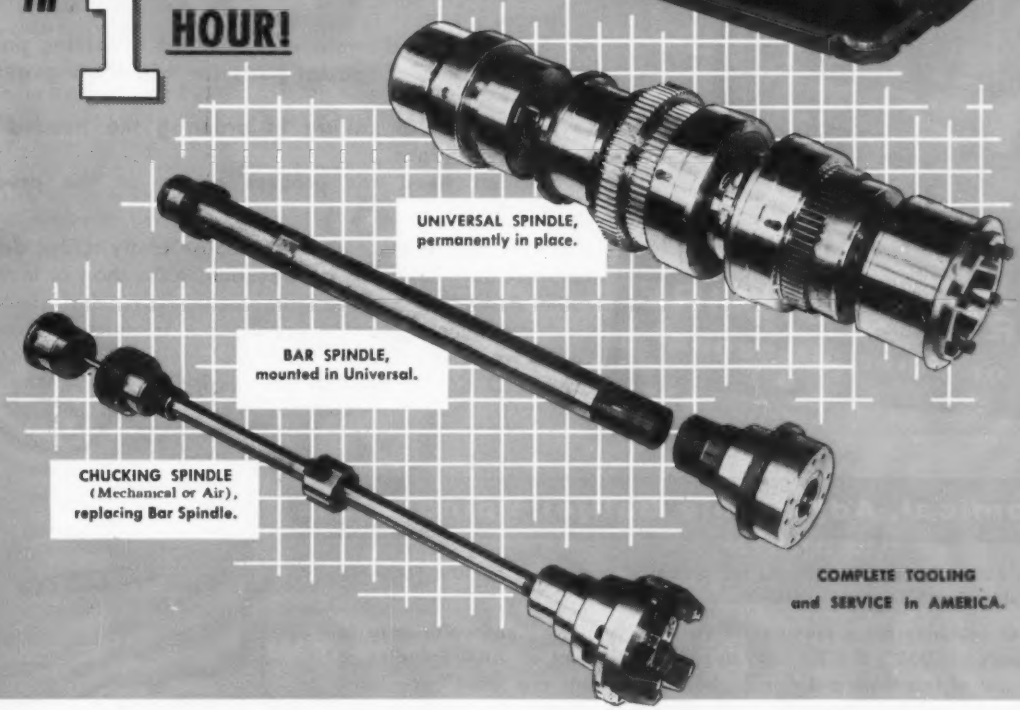
(*Continued on page* 276)

TAREX AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

The ability to change from BAR work to a CHUCKING machine in 1 HOUR!




UNIVERSAL SPINDLE, permanently in place.
BAR SPINDLE, mounted in Universal.
CHUCKING SPINDLE (Mechanical or Air), replacing Bar Spindle.

COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

SHEFFIELD

Adjustable AIR GAGE TOOLING for Short Runs and Emergencies

SUCH AS:

- **Aircraft manufacturers, subcontractors and job shops having limited production.**
- **Accidental damage to a vitally needed single purpose gage.**
- **An unexpected engineering change involving part size.**
- **A short run of special parts for which no gages have been provided.**
- **A mistake or failure in ordering the needed single purpose gages.**
- **Sudden need for process gages at the production machines.**

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the tooling here illustrated is your best insurance against unpredictable production losses.

Write Dept. 9 for descriptive engineering data. ***THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.***

Economical, Adjustable Balljet Spindle Kit

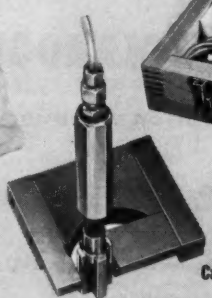
In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3" in diameter.

Consider economy for a moment. If the holes you may encounter vary in increments of .001", this Kit provides the equivalent of 2000 Spindles at a unit cost of less than a dollar. If those increments are .0001" you have available 20,000 Spindles at about a dime each. That is real economy.

No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.

Balljet Spindle assembled

Balljet Spindle in use



Calibrating Fixture

Adjustable Balljet Spindle Kit

Adjustable Airebore Gage

Adjustable Airebore Gage

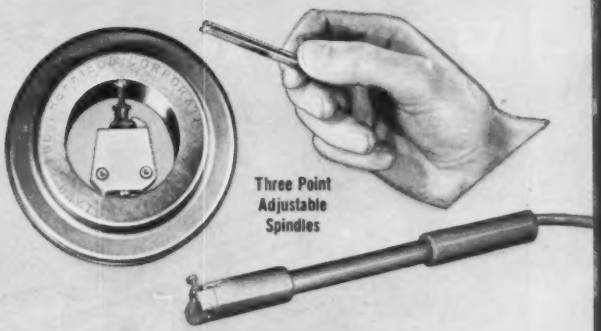
Airebore Gage in use

Airebore Gage assembled

The Airebore Gage can be set precisely to measure any diameter hole from 3″ to 12″. And like the Adjustable Balljet Spindle, it is set up with a calibrator and gage blocks. No master setting rings are needed.

The Airebore Gage is self-centering—needs only to be rocked in place for precision action. It is light in weight with all contact surfaces of tungsten carbide—nothing to wear out.

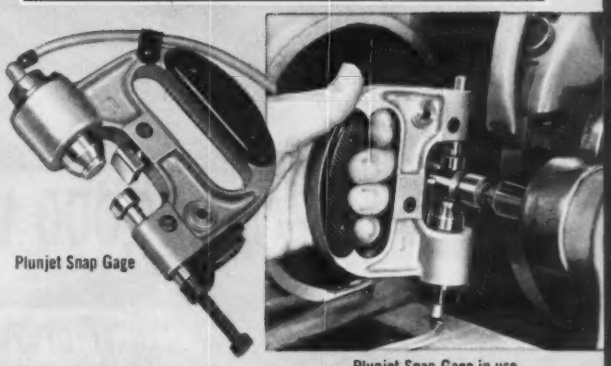
Three-Point Adjustable Spindles



Three Point Adjustable Spindles

The Three-Point Adjustable Spindles, four of them, cover respectively the ranges, ⅜″ to 9/16″, 9/16″ to 1″, ⅞″ to 1½″ and 1½″ to 3″. They can be set up with gage blocks.

Plunjet Indicator Snap Gage



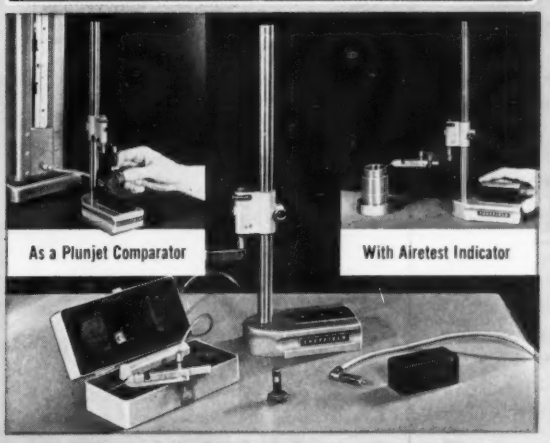
Plunjet Snap Gage

Plunjet Snap Gage in use

The Plunjet Gaging Cartridge may be substituted for the Dial Indicator to assure consistent, repetitive readings, especially when tolerances are .001″ or less.

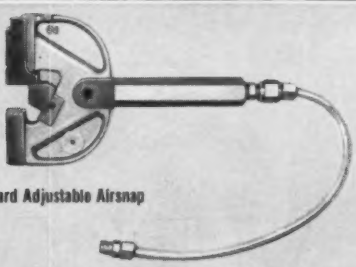
Twelve Plunjet Snap Gage models cover the gaging range of 0″ to 12″. Larger sizes are available on special order.

Airetest and Plunjet Stand



A new, highly versatile stand accommodates a dial indicator or an Airetest Indicator—also converts to a comparator by using a Plunjet and anvil as illustrated.

Standard Adjustable Airsnaps



Standard Adjustable Airsnap

The Standard Adjustable Airsnap in 17 models covers the range .2500″ to 5.500″. Up to 3.000″ the adjustable anvil has a maximum adjustment of ¼″. Above that the maximum is ½″.

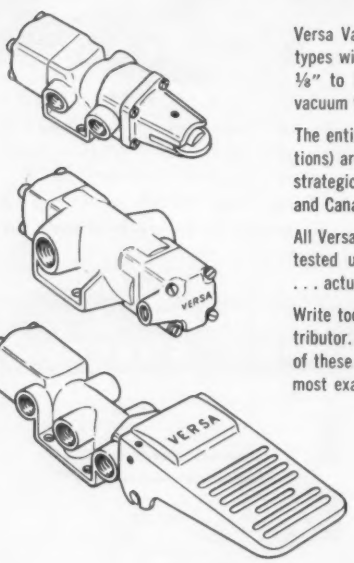
GOLDEN ANNIVERSARY HEADQUARTERS

VERSA Control Valves

FOR IMMEDIATE DELIVERY...

Cut-away view of VERSA Double Solenoid Valve, 4-way type.

in Over 110,000 Variations!



Versa Valves are available in 2-, 3-, 4-, and 5-way types with over 20 actuating devices, in sizes from ⅛" to 1" N.P.T., and for pressures from partial vacuum to 500 PSIG.

The entire line of Versa Valves (over 100,000 variations) are stocked by authorized Versa distributors, strategically located throughout the United States and Canada.

All Versa Valves are triple pressure and functionally tested under water for guaranteed leakproofness . . . actually exceed J.I.C. standards.

Write today for the name of your nearest Versa distributor. Remember, you can get immediate delivery of these rugged, compact control valves to fit your most exacting hydraulic or pneumatic requirement.

The entire line of VERSA Valves is explained in our new comprehensive Folder #14

VERSA

VERSA PRODUCTS COMPANY INC.
249 SCHOLES STREET
BROOKLYN 6, N. Y.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilness)
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BLAST CLEANING EQUIPMENT
Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.,
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page 280*)

For more information fill in page number on Inquiry Card, on page 219

THE TREND TO CECO-DROPS...

JAMESTOWN, N. Y.

SITUATION: Growing sales were taxing production capacity of tool mfr's. forge shop. Had four belt-driven board drop hammers.

SOLUTION: Four Ceco-Drops now in operation —have been giving excellent service. Production is up—maintenance is down. "3 hours charged against Ceco-Drops in 42 days" —"One Ceco-Drop ran 108 hrs. (21 days) without maintenance or die work."

ALLENTOWN, PA.

SITUATION: Tool works had the problem of keeping 23 "old dog" board drop hammers operating profitably. Had but one recent model "J" Chambersburg Board Drop.

SOLUTION: Management launched a modernization program calling for nine Ceco-Drops capable of producing a yearly tonnage in excess of the 23 old board drop hammers. Four of the Ceco-Drops are now in operation, shop layout has been revised. Efficiency and production methods have been improved.

FLINT, MICH.

SITUATION: Large Auto Co. with 16 Board Drop Hammers—(7 of them Chambersburg "J's")—ranging in age from 7 to 30 years. Lowered production rates and mounting maintenance costs.

SOLUTION: Started modernization in 1953. Converted* four "J's" with Ceco-Drop upper works. Cost and down time reduced —production up—operators like them. Other "J's" to be converted*. Ceco-Drops will replace older board hammers.

*Saves cost of anvil and foundation!

COLUMBUS, O.

SITUATION: Job shop with 5 Board Drop Hammers finds equipment obsolete—cannot compete with lower prices and higher production of other more modern shops.

SOLUTION: Initiated 10 year program of modernization to include 15 Ceco-Drops. Three Ceco-Drops already installed to replace board drop hammers.

SKOKIE, ILL.

SITUATION: One of largest manufacturers of hand tools is planning a new shop. Decided to have modern Gravity Drop Hammers.

SOLUTION: Selected Ceco-Drops, and on a programmed basis is replacing board drop hammers with Ceco-Drops. To date, two 2,000 lb. Ceco-Drops and one 2,500 lb. Ceco-Drop are in operation — "Doing fine". Another 2,500 lb. Ceco-Drop on order.

The gravity drop hammer with short stroke control

. . . and remember the Lansing Story?

LANSING, MICH.

Lansing, Mich. is unique among industrial cities in the concentration of drop forging activity in its many factories. It may well claim the title of "Drop Forging Capital of the World". In Lansing are six great forging shops covering 14 acres of land, with a working area of 985,579 sq. ft. All these great forging shops are using Chambersburg Ceco-Drops.

Forge Shop No. 1—installed the first Ceco-Drop in 1947—now forging connecting rods.

Forge Shop No. 2—has installed 6 Ceco-Drops since 1950—making automotive forgings.

Forge Shop No. 3—bought 4 Ceco-Drops since 1948—Commercial and automotive forgings.

Forge Shop No. 4—bought seven Ceco-Drops in the last six years.

Forge Shop No. 5—Purchased 3 Ceco-Drops in 2 years.

Forge Shop No. 6—One of largest in world Installed 11 Ceco-Drops since 1951.

CHAMBERSBURG ENGINEERING CO.

CHAMBERSBURG • PENNSYLVANIA

production begins with

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 50 years. Talk over your special problems with us. Absolutely no obligation. Write today.

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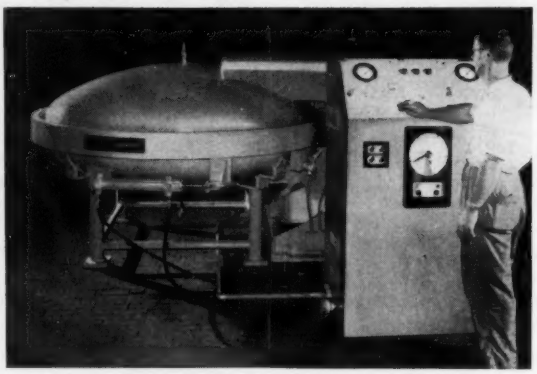
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

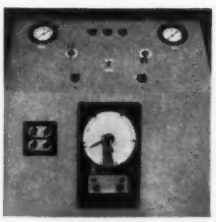
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

Completely Automatic
AUTOCLAVES
by Philips & Davies



True "push-button" operation is featured in these new and unique Autoclaves by Philips & Davies, Inc.—with all cycles and operations COMPLETELY AUTOMATIC! Cycling and operation is controlled with pin-point accuracy, with an automatic timer, automatic heat control, automatic cycling control, automatic air control, automatic water control, and automatic steam control—plus automatic hydraulic opening, closing and locking of the unit.

One man and a helper can operate a bank of up to EIGHT Autoclaves. Savings in time and labor over the old manual control methods are tremendous—besides giving better finished work due to rigid control in every step of the operating procedure. In any industry where HEAT UNDER PRESSURE IS REQUIRED TO PROCESS MATERIAL, the Philips and Davies completely automatic Autoclave will COMPLETELY REVOLUTIONIZE your procedures—give you enormous savings, faster processing, better quality and more accurate work!



Close up of front of control panel.

THE AUTOCLAVE'S "MAGIC BRAIN" is in this unique control mechanism. Its push-button operation maintains constant pre-set temperatures during all of the cycles, and it records a *written record* of each complete cycle. Once the operator starts the cycle by pushing load button—operation is *completely automatic!* It's the last word in *precision* automatic control!

Interior of control panel with covers removed.

WRITE TODAY for descriptive folder and complete details!

QUALITY HEAVY MACHINERY SINCE 1877

p & d

PHILIPS & DAVIES, INC.
Kenton, Ohio

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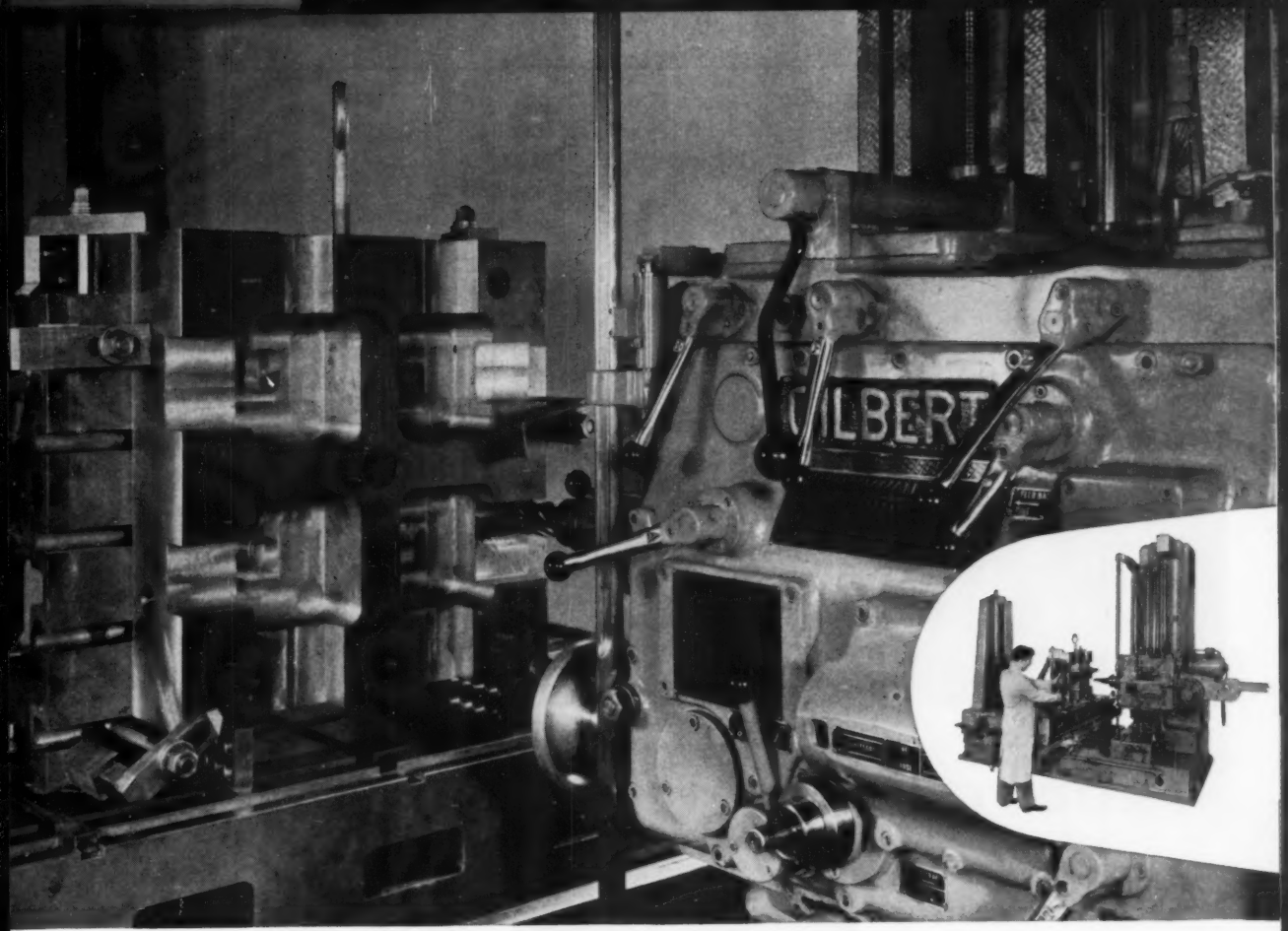


courtesy Mohawk Tool & Die Corporation and Macaulay Machinery Co.

30 percent savings and ±.001"

. . . match it with a Gilbert

How's this for a perfect lineup: 30% savings in floor-to-floor time over previous machines, and ±.001" for mating the two chases of a four-cavity carburetor bowl mold.

Mohawk Tool & Die Corp., Rochester, N.Y., gets these savings and accuracy by handling the job on a Cincinnati Gilbert horizontal boring mill.

Here the lower chase (of hot work die steel) is being rough machined. Then it's hardened to a Rockwell of 48-50C scale. Finally, the chase is finish machined with carbide to an accuracy of ±.001" for guide pin and bushing holes, four cavity pockets, and eight slide ways.

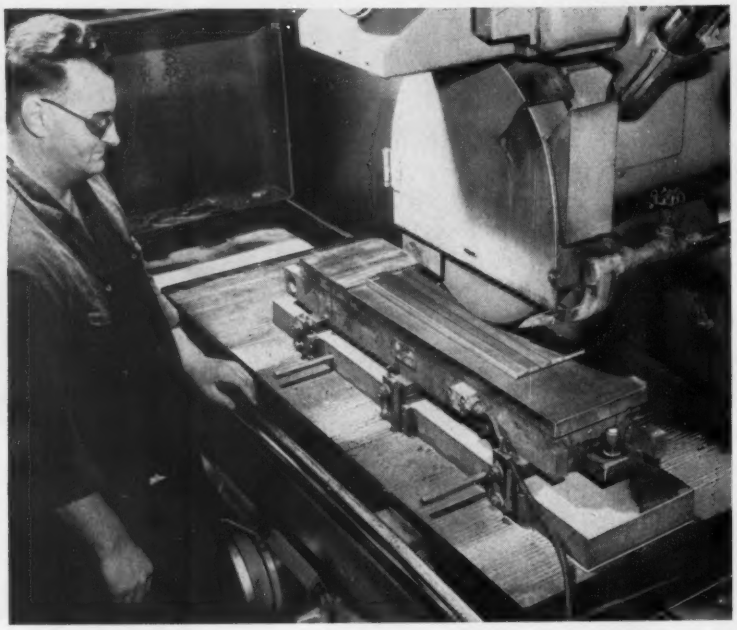
Says Mr. George Neward, Mohawk's Secretary-Treasurer: "This job illustrates the flexibility of this type of machine. The ruggedness and stability of the Cincinnati Gilbert has been proven to us without doubt."

The comparatively low cost of adding these advantages to your operations will surprise you. Write for new literature, or—better yet—get a proposal from Gilbert now.

The Cincinnati Gilbert Machine Tool Co.,
3366 Beekman Street, Cincinnati 23, Ohio

You can buy a new compound table type Gilbert horizontal boring mill on a 5-year payment plan for as little as $5580 down and $428.36 a month. This is $1.28 an hour on a two 8-hour-shift operation. Includes low 6% simple interest (3% add on).

those who buy Gilbert buy **GILBERT** *again*



Magna-Lock chuck holds six tapered gibs during roughing operation.

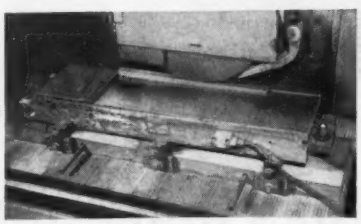
PRODUCTION UP 25%

with

ELECTRO-MAGNETIC

Magna-Lock

CHUCK

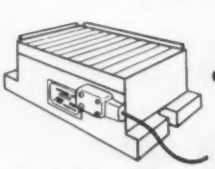


Magna-Lock chuck holds gib during finish grinding.

At Gisholt Machine Company, roughing and finishing operations on 24″ tapered gibs are done on a surface grinder. The gibs are held by a Magna-Lock chuck and are rough ground six at a time and finish ground individually. Spindle and table speeds for both operations is 1200 r.p.m. and 100 f.p.m. respectively. Stock removed is .020″ to .025″. There is no scrap, no rejects. Fixture set-up time is eliminated. Since using the Magna-Lock chuck, production has increased 25%.

This is one of the many examples of how the *extra holding power* of Magna-Lock all-steel, all-welded electr magnetic chucks steps up production, reduces costs.

Solve your holding problems with Magna-Lock magnetic chucks—a complete line to meet your requirements. WRITE TODAY, Dept. M-56.



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U. S. A.

designers and makers of a complete line of magnetic chucks and devices.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLT AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Machine Tool Co., Ann Arbor, Michigan
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page 282*)

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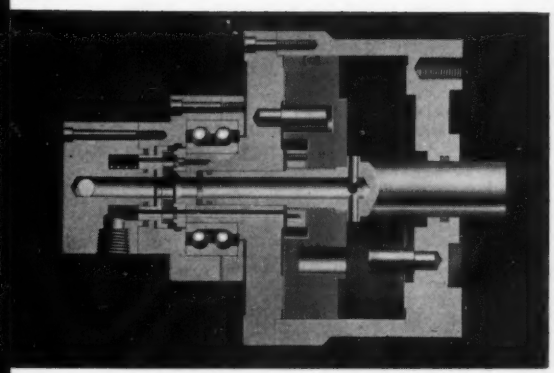
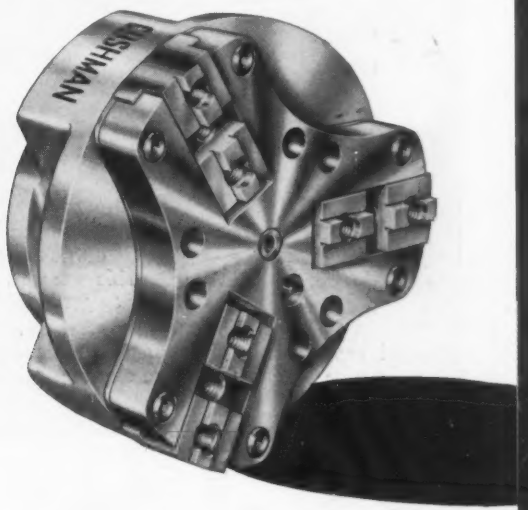
CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY: The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . .through design and selection of the right work-holding devices.





Typical Cushman Air Operated Chucks and Cylinders for repetitive machining operations permitting increased production at lower costs.

the key to machining efficiency

Today's repetitive manufacturing demands *efficient* and *economical* operation of high speed machine tools. Cushman Air Operated Chucks and Cylinders give you **Chuck-ability** with satisfactory performance under the punishment of constant day-in and day-out service . . . no loss of chuck or cylinder efficiency over a long service life . . . no air leakage problems . . . and the feature of *quick* loading and unloading of workpieces at the touch of foot or hand.

Chuck-ability is available to you in Cushman's complete line of manually and air operated precision chucks, designed and manufactured to meet today's high metal working quotas at lower production costs.

Write today for catalogs fully describing Cushman Chucks. Or, should you have a particular work-holding problem, Cushman can give you **Chuck-ability** in a special chuck, designed and engineered to your requirements.

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a world standard for precision

CUSHMAN the CHUCKMAN CHUCKS AND ACCESSORIES Exclusively SINCE 1862

CUSHMAN CHUCKS . . . *A Product of American Quality, Labor and Materials.*

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manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plat J w .

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AT NO EXTRA COST
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TO UNLOCK
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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
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Cincinnati, Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bon St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(*Continued on page 284*)

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The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

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Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown Ohio.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

(*Continued on page* 286)

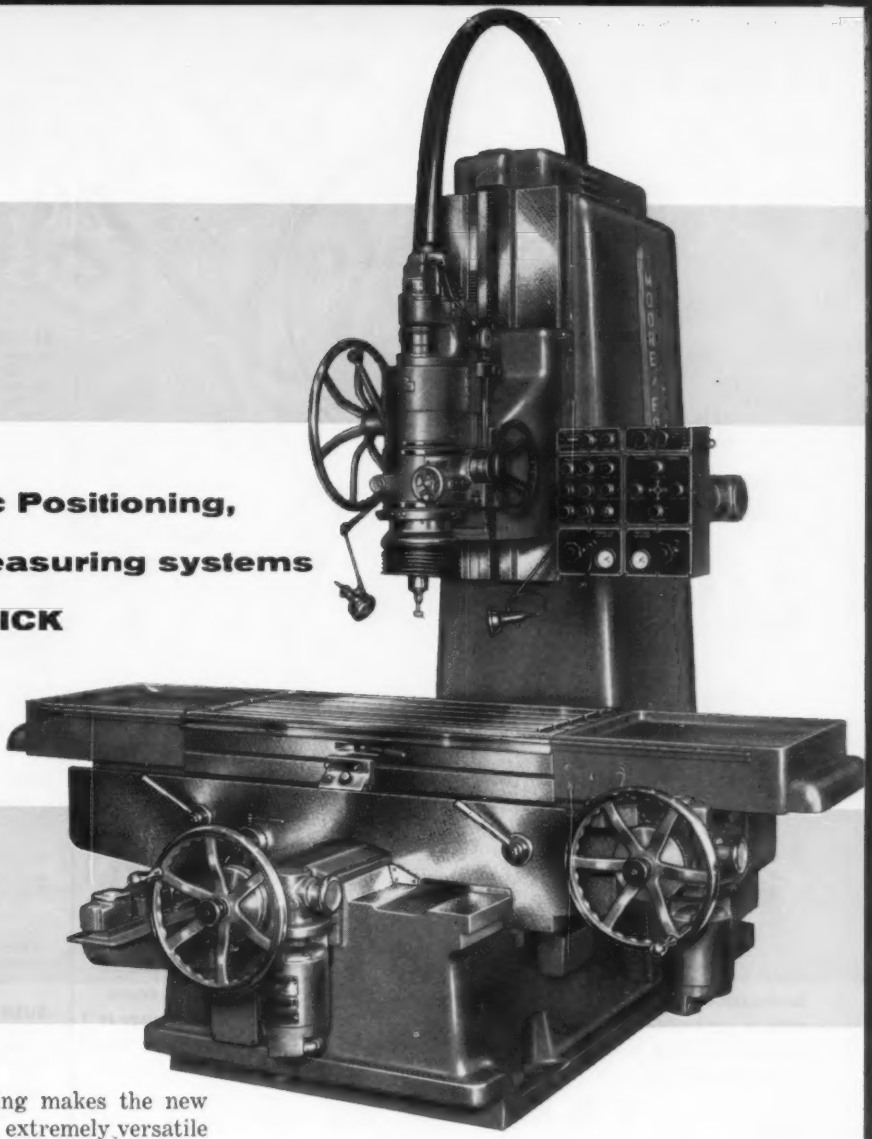
For more information fill in page number on Inquiry Card, on page 219

NOW... Automatic Positioning,

choice of two measuring systems

on MOORE-FOSDICK

Jig Grinder!



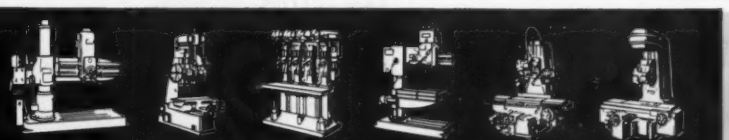
Exclusive automatic positioning makes the new Moore-Fosdick Jig Grinder an extremely versatile machine! Besides large work capacity (22" x 44" or 18" x 36" x 27" height) you get increased speed and precision. At the touch of a button, table and saddle position automatically to ± .0001"!

A choice of two precision measuring systems is available. With the new and exclusive Direct Dimension Measuring, dimensions from blueprint are simply set on direct-reading drum dials. The other system, Rod and Bar Measuring, employs measuring rods, micrometers, and for high production work, duplicating bars. Either measuring system may be installed with or without automatic positioning, but both systems cannot be installed on the same machine.

On the Moore-Fosdick Jig Grinder you can grind conical holes with taper in either direction, as well as cylindrical holes. An angular and indexing device built into the main spindle, and the recently developed slot grinding attachment, give quick, accurate grinding of any contour — *regular or irregular*. Write for price and delivery information.

Other outstanding features include: infinite range of grinding speeds—12,000 to 60,000 rpm, contour and chop grinding, spindle-housing heat control.

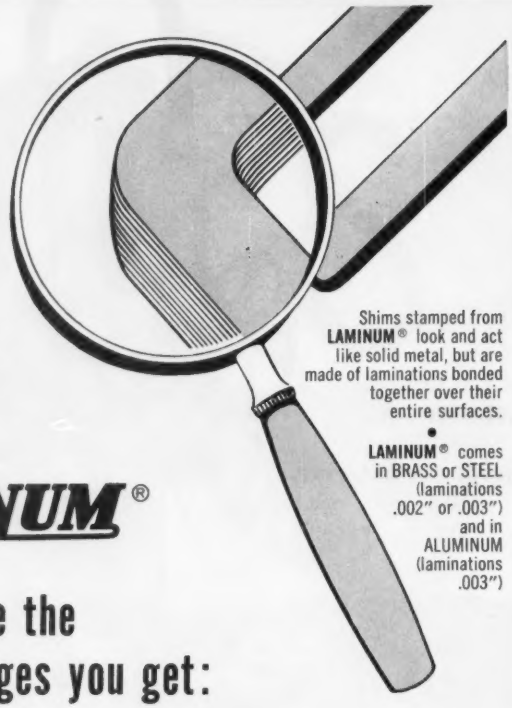
NEED JIG GRINDING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK



when a shim is

LAMINUM®

Shims stamped from LAMINUM® look and act like solid metal, but are made of laminations bonded together over their entire surfaces.

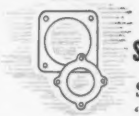
•

LAMINUM® comes in BRASS or STEEL (laminations .002" or .003") and in ALUMINUM (laminations .003")

here are the advantages you get:

REDUCED MACHINING COST:

You machine only to easy tolerances. The laminated shim is *adjustable*—you simply peel laminations of .002 inch or .003 inch with a penknife—to get exactly the spacing you need. You cut costs without sacrificing quality.



SIMPLIFIED USE:

Shims come to you in one "pack" for each application. They are precision-stamped to your exact specifications. No counting, no stacking, no miking. Gauge is always known. No dirt or grit can lodge between layers.

SPEEDED PRODUCTION:

Final fitting can be done right at the job. You don't have to take parts back and forth for further machining, grinding or filing. No special skill required. The laminations adjust spacing quickly, easily.

ADDED SERVICE FEATURE:

Throughout the life of the machines you produce, the simple removal of a shim lamination provides a unique adjustment for the take-up of wear. Original clearances can always be restored.

SEND TODAY for our Engineering Data File

LAMINATED SHIM COMPANY, INC.

3905 UNION STREET • GLENBROOK, CONNECTICUT

FLASH! Now also made of **STAINLESS STEEL** in layers of .002" or .003"

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Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

American Crucible Products Co., Lorain, Ohio
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
Shenango-Penn Mold Co., Dover, Ohio

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy. Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., 2351 11th St., Rockford Ill.

(*Continued on page* 288)

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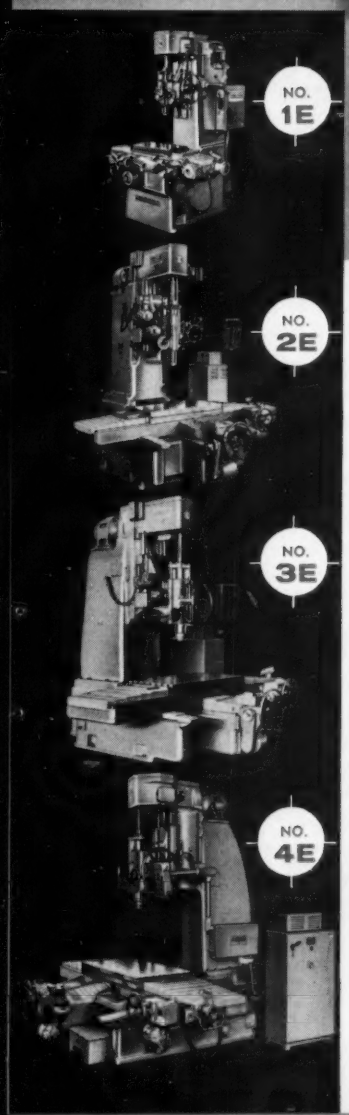
Get to the POINT... *in a hurry!*



with

PRATT & WHITNEY *Electrolimit* JIG BORERS

The point we'd like to make is that Pratt & Whitney Electrolimit Jig Borers incorporate an exclusive method of locating the table that is *unbeatably* fast and convenient . . . and accurate to .0001".
Thanks to the P&W Precision Preloaded Ball Roll Quill, you'll be able to retain original accuracy and rigidity *indefinitely* without any adjustment or maintenance.
And there'll never be any loss of accuracy from wear.

NOW . . . Pratt & Whitney Electrolimit Jig Borers can also be furnished with positioning control by NUMERICAL DATA.

. . . **COMPLETE LINE** includes table sizes from 12"x24" to 36"x72".

Write for free copy of P&W Electrolimit Jig Borer Circular No. 587 . . .

ALSO FURNISHED . . . a full line of Pratt & Whitney End Measure Jig Borers which also deliver "tenths" accuracy year after year.

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INCORPORATED
12 Charter Oak Boulevard, West Hartford, Connecticut
Representatives in Principal Cities Throughout The Country

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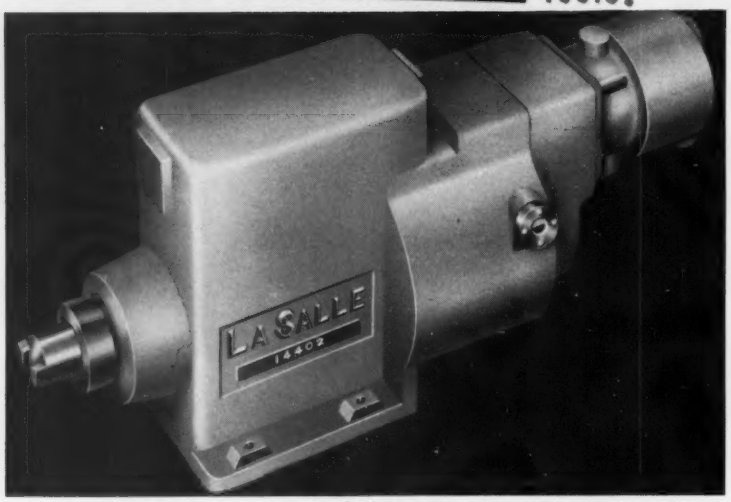
La Salle

AUTOMATIC POWER WRENCH

practically eliminates breakage of cutting tools!



IT'S NEW!

two-speed fully automatic power

It's synchronized with the machine cycle to give you automatic engaging and disengaging of parts. Controlled torque eliminates positively all guesswork in clamping pressure.

operates on machine tool principles

A high speed low torque approach; a low speed high torque clamping; and a low speed high torque break clamp and a high speed low torque return.

STARTLINGLY DIFFERENT!

features fluid motor drive

You can clamp light parts or parts with thin-walled areas without fracturing and you can always repeat the clamping torque from cycle to cycle.

GOOD NEWS FOR PRODUCTION MANAGERS!

fits any type of production machine

They're designed to fit any special or any standard machine in use today—such as Multiple-Drilling Machines, Lathes, Boring Mills, Grinders, Screw Machines or Thread Millers

unit mounted quickly

The design permits either vertical, horizontal or angular mounting—to serve your particular needs.

now available in two standard sizes

Smaller model has a torque capacity up to 1200 inch/pounds; larger model from 800 to 5000 inch/pounds. To control and regulate properly a hydraulic power package is provided.

La Salle tool, inc.

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CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Aves., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Shenango-Penn Mold Co., Dover, Ohio

CASTINGS, DIE

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Shenango-Penn Mold Co., Dover, Ohio

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

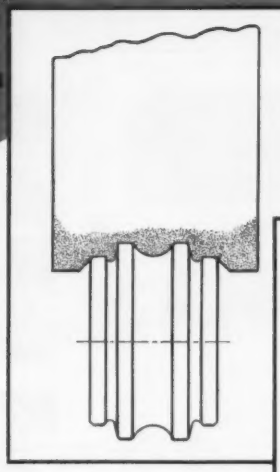
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page* 290)

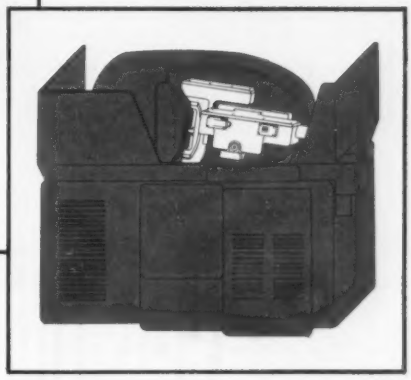
Now

COMPLEX CONTOURS ON GRINDING WHEELS

never before possible



on Micro-Centric Grinders



with the new

HOGLUND CONTOUR WHEEL DRESSER

THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES

20 MILLIONTHS ACCURACY in forming ball race grooves, single or multiple—besides generating complex oil seals to accuracy of tenths in ONE SINGLE AUTOMATIC OPERATION with only the size and shape of the diamond as a limiting factor.

MODEL 81 uses a pair of enlarged synchronized cams to control the diamond movements.

An accurate swinging yoke insures super accurate radii in the ball race groove.

DIAMONDS travel at UNIFORM peripheral speed over the whole contour.

Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the Hoglund way of practically eliminating skill in production grinding.

Check these features of HOGLUND *Wheel* DRESSERS

Precision

Automaticity

Will dress any angle on the grinding wheel, perpendicular as well as horizontal.

Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle (can even undercut grinding wheels, if necessary).

Eliminates necessity of skill in contour grinding.

Set up time negligible. No skill required.

Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.

Uniform peripheral dressing speed of diamond.

HOGLUND FOR ACCURACY

HOGLUND

ENGINEERING & MANUFACTURING CO.

345 Snyder Ave., Berkley Heights, N. J.

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CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page 292*)

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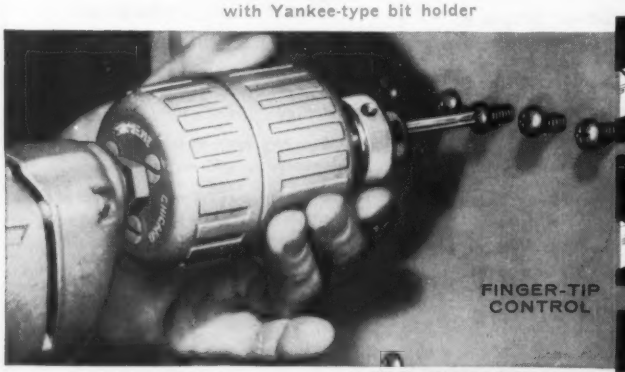
REVERSIBLE
SPEED REDUCER

Fits all portable drills . . . reduces speed, increases torque seven times. Ask your distributors to show you the . . .

Supreme Versamatic
PROFESSIONAL MODEL
No. 4000-P
with Yankee-type bit holder



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Engineered and manufactured by the makers of
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UP FRONT on America's leading power tools
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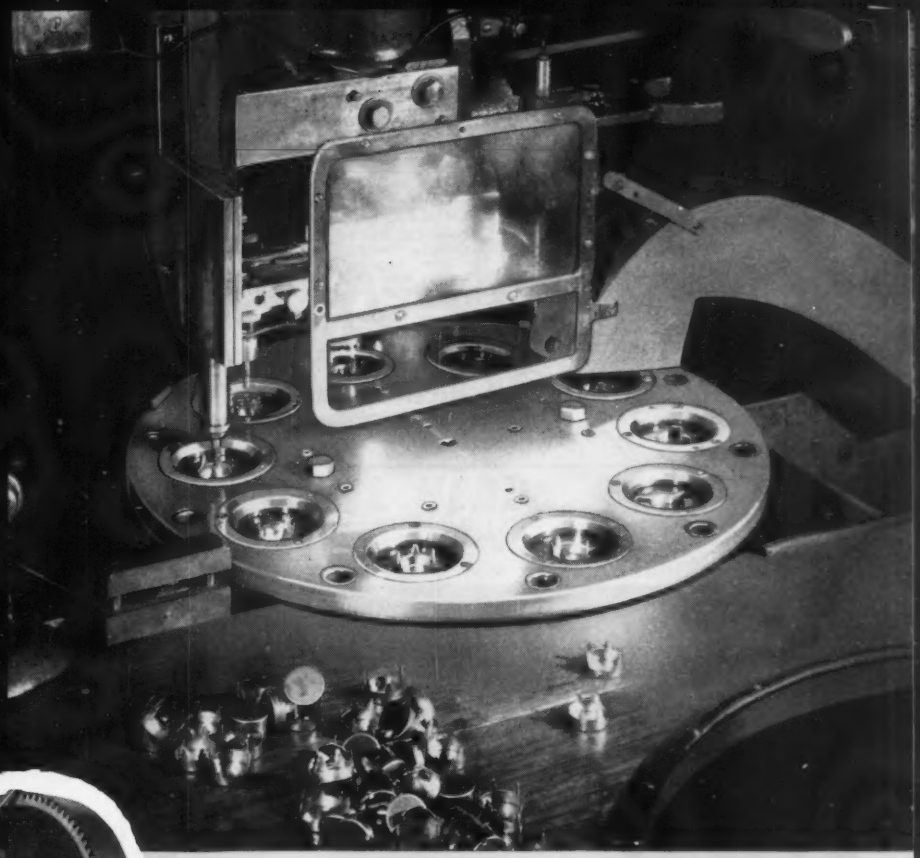
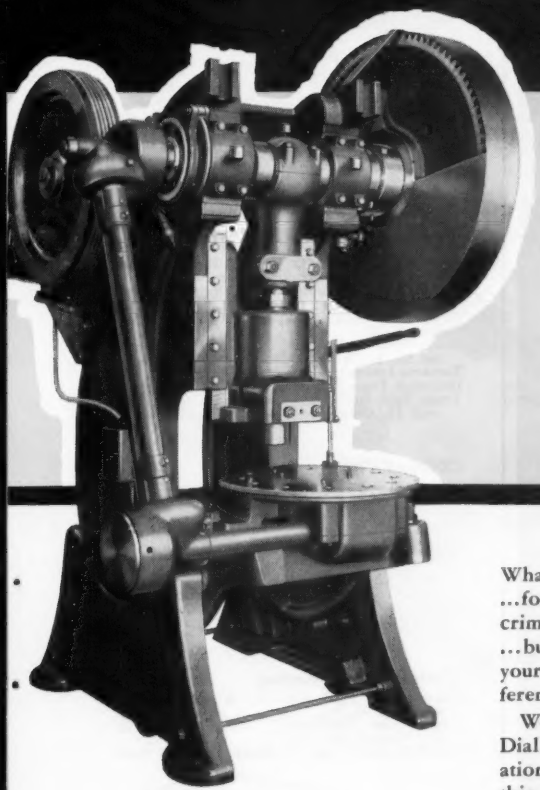
MODERN FEDERAL DIAL FEEDS have what it takes!





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Capacity, 80 tons

VERSATILITY plus AUTOMATION

What's the job? Drawing... staking ...forming... piercing... stamping... crimping... punching... broaching ...burring... assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. *Write for new Dial Feed Catalog.*

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601 Division Street, Elkhart, Indiana

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31 Years' Experience in Dial Feed Engineering and Construction

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Hanchett Magna-Lock Corp., Big Rapids, Mich.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

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General Electric Co., Schenectady 5, N. Y.

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General Tool Sales Co.
PHOENIX
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Ralph Espositio & Company
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Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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(*Continued on page* 294)

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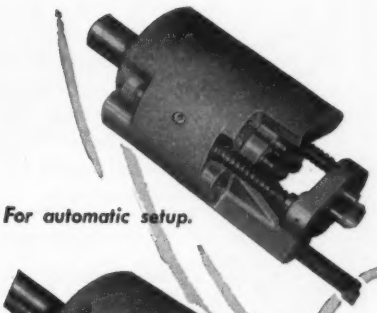
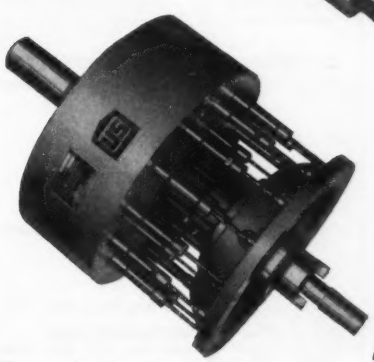


For automatic setup.

For semi-automatic setup.



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(*Continued on page* 296)

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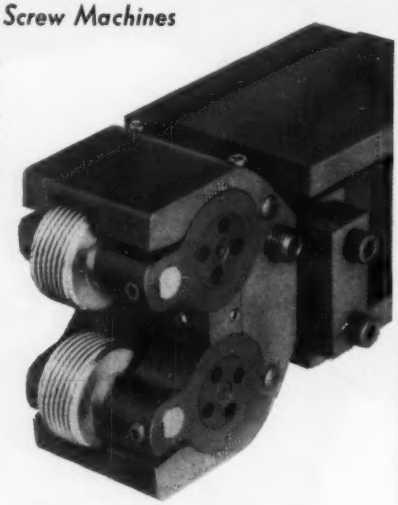

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B 13	1/8"-13/16"	9	90
B 18	1/4"-1 1/8"	15	105
B 36	3/8"-2 1/4"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

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(*Continued on page* 298)

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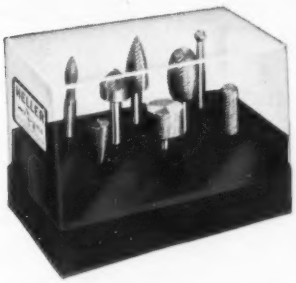

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in the

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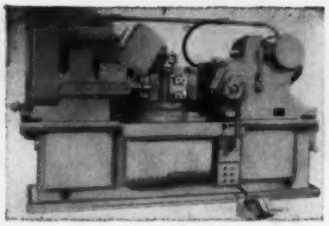

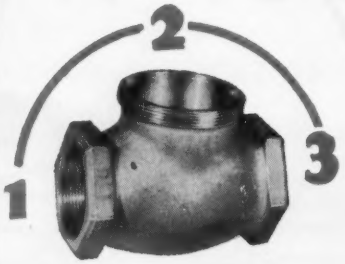

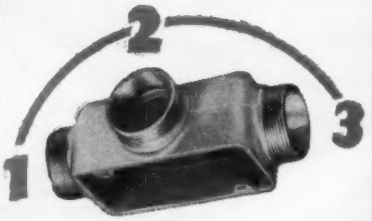

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See Compounds, Cutting, Grinding, Etc.

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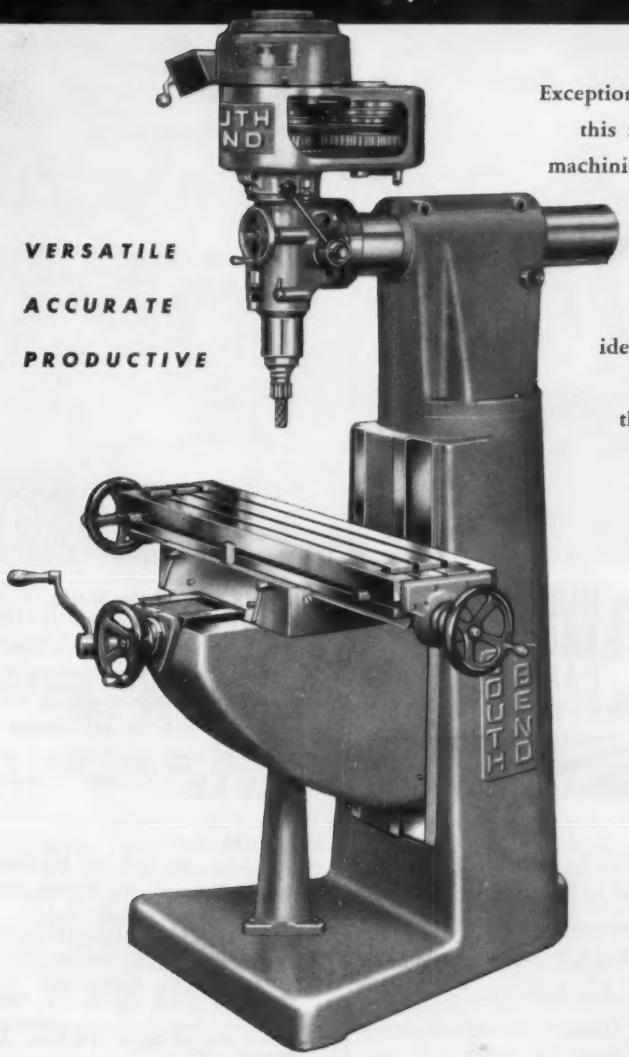
(*Continued on page* 300)

New SOUTH BEND VERTICAL MILLING MACHINE



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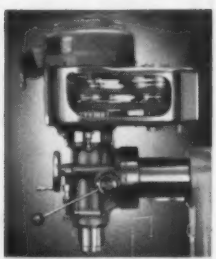
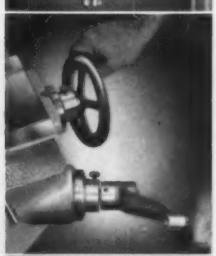


LO-LOSS spindle drive. Precision ground and fitted quill.



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Power longitudinal table feed and automatic quill feed optional.

SPECIFICATIONS

Longitudinal table travel	20″ or 30″
Cross feed	9½″
Spindle to table (max.)	20″
Spindle to column (max.)	20″
Ram travel	15″
Spindle speeds (8)	135 to 3750 r.p.m.
Spindle travel	4″
Head rotation	360°

SOUTH BEND LATHE

425 East Madison Street
South Bend 22, Indiana

For more information fill in page number on Inquiry Card, on page 219

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HIGH SPEED AND CARBIDE

MORE AND MORE THE experts choice

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Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.

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See Sawing Machines, Circular

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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive

Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Shenango-Penn Mold Co., Dover, Ohio
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Pneumatic

Shenango-Penn Mold Co., Dover, Ohio

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page* 302)

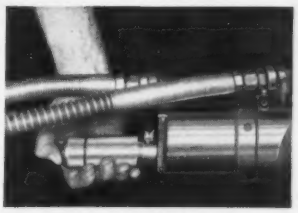
ACTION PICTURE
of how to save money by riveting!

This action photo, taken on the frame assembly line in one of the largest auto factories, illustrates how cost-conscious manufacturers save money with Hannifin "Hy-Power" Hydraulic Riveters.

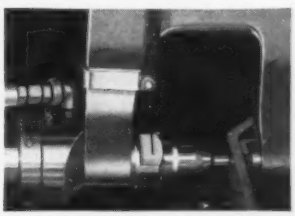
First step in assembly is to rivet the frame together... with Hannifin "Hy-Power" Riveters. The light-weight forged C-Frames hang from balancers within easy reach of each operator. No special skill is required to head the ⅜" rivets, cold, each in seconds. What's more, this "silent squeeze" method forms stronger, more uniform rivets, hot or cold.

Power source is the Hannifin "Hy-Power" Hydraulic Pressure Generator which quietly supplies pressure to the "Hy-Power" Cylinder that does the work. These riveters are available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities.

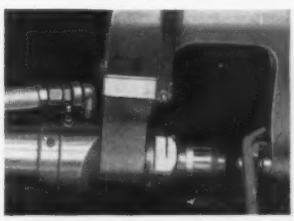
here's the HANNIFIN "HY-POWER" WORK CYCLE



In position. A single control button starts (or interrupts) the automatic Hy-Power cycle.



Ram approaches fast, then hydraulic pressure automatically intensifies, and the rivet head is formed.



Fast, automatic return. Total elapsed time to head a rivet is only 2 to 3 seconds.

"HY-POWER" CAN ALSO BE USED IN MULTIPLE TO SET SEVERAL RIVETS

Bulletin 150 tells how to save money on riveting, staking, punching, forming and bending operations. Write for copy.

do ALL you can do... with

HANNIFIN

Hannifin Corporation, 509 South Wolf Road, Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

For more information fill in page number on Inquiry Card, on page 219

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Walker, O. S. Inc., Worcester, Mass.

DESIGNERS, Machine and Tool
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING
See Castings, Die

DIE-CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.

DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian Mich.
Pratt & Whitney Co. Inc., West Hartford, Conn.

DIE SETS, Standard
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co. Inc., West Hartford, Conn.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS
See Stocks, Die

DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

DIES, Sheet Metal, Etc.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton. Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Machine Works, Waltham, Mass.

DIES, Threading
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

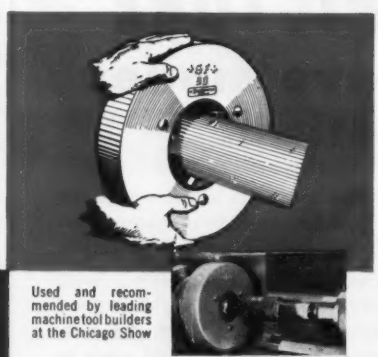
DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DIES, Thread Rolling
Pratt & Whitney Co. Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DISCS, Abrasives
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.

(*Continued on page* 306)

SKINNER
+GF+
WORK DRIVERS



Used and recommended by leading machine tool builders at the Chicago Show

...the best for turning on centers!

They're fast, powerful — the ideal means for driving smooth or rough bars and forgings located on centers! Jaws are easily reversed to accommodate direction of spindle rotation. Five sizes handle work from ¼" to 8 1/16" diameter.

• ½ turn does the clamping — no wrenches needed
• Each size has wide clamping range • Cuts clamping and unclamping time • Clamps out-of-round work evenly
• Clamping force always matches cutting pressure.

Write Skinner or your Skinner distributor for folder.

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.

For more information fill in page number on Inquiry Card, on page 219

a MIGHTY fine press...

built to withstand rigorous service

From crown to base, Minster S1's are truly MIGHTY presses. You get these features as Standard Construction:

- ★ Box type cast construction for maximum rigidity
- ★ All wear surfaces bronze lined, precision fitted and replaceable
- ★ Minster patented Combination Multiple Disc Air Friction Clutch and Brake
- ★ Exceptional Slide guiding and barrel type adjustment
- ★ Air Counterbalances on slide
- ★ Totally enclosed gears running in oil
- ★ J. I. C. Dimensions

MINSTER
series **S1**
straight side single point presses

for drawing, forming, trimming or blanking.

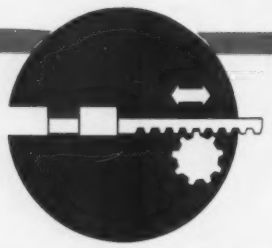
capacities
from 50
to 600 tons

Photo courtesy of Long Manufacturing Division, Borg-Warner Corporation, Detroit, Michigan. Minster S1-500 Press used in production of clutch coverplates for the automotive industry.

THE MINSTER MACHINE COMPANY
Minster, Ohio

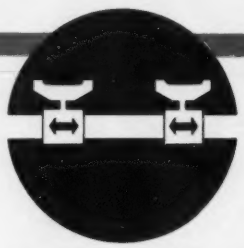
MINSTER®

Flexible Automation



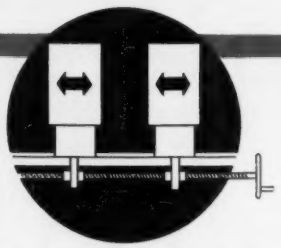
Variable Length of Feed Stroke

Changing from one job to the next is a simple matter in Transflex. Feed stroke is readily adjusted so that the part may be indexed any distance required by the number and size of the dies used.



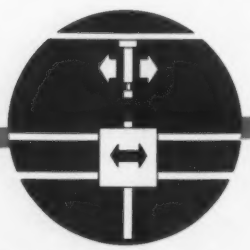
Adjustable Feed Fingers

Simple adjustments are provided so that the feed fingers can be quickly respaced along the feed bar to accommodate varying feed lengths. Fingers may be easily changed to grip parts of different dimensions.



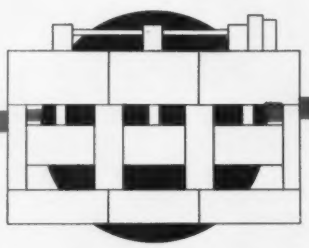
Adjustable Cushion Positions

Die cushions in a Transflex press are mounted on a track within the press bed. No matter where you want blankholding pressure, Transflex cushions can be moved laterally to that position by an adjustment mechanism outside the bed.



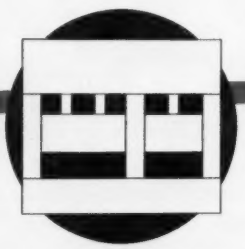
Adjustable Knockout Positions

Transflex presses are furnished with adjustable knockout positions. Air cylinders prevent the slide from picking up the part on the upstroke. Positive mechanical knockout is also provided in the event a part becomes so firmly seated in the dies that the cylinder remains compressed. Both cylinders and rods are adjustable left and right.



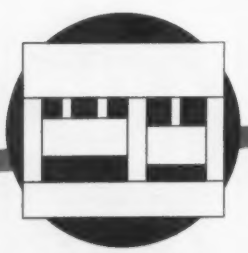
Modular Construction

An entirely new concept of press design and construction, modular press units provide the manufacturer with a means to alter the physical characteristics of the presses. A manufacturer can now have insurance against long range obsolescence of equipment. Modular construction provides a means to add or subtract crowns, beds, slides and uprights —to create a composite press tailored to the manufacturer's general requirements.



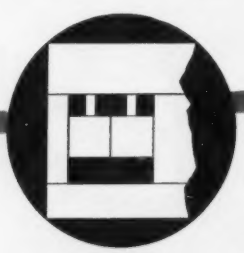
Multiple Slides

When a series of transfer operations presents extremely unbalanced load conditions, Clearing provides multiple slide construction. Two or more slides with completely different capacities are operated in a single press.



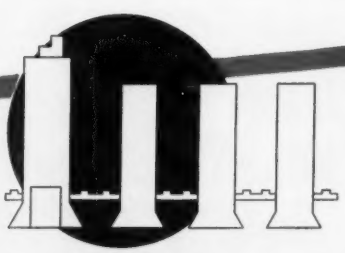
Skip Stroke

When two parts, which are similar except for one key operation, are to be produced simultaneously, Clearing offers a unique skip stroke action. One slide in a multiple slide press will skip every other stroke to allow the transfer mechanism to index twice. In this way a pair of parts are produced at every second stroke of the press.



Split Slides

Clearing presses with split slides offer the manufacturers a means to obtain balanced production of pairs of parts where both parts are produced on the same press. Instantaneous die changing is possible by adjusting one slide up and the other one down. Split slide construction eliminates any effects of unequal loading of the slides.



Lead Press

A manufacturer wishing to automate a line of existing presses may purchase a Clearing lead press equipped with a fully adjustable Transflex feed mechanism. The feed is constructed in incremental units so that the press line can be modified—presses added or subtracted—at any time.

the new CLEARING transflex press

Transfer Feed Efficiency + Flexibility

Here at last is automation *plus* flexibility. The new Clearing Transflex makes it possible to take full advantage of transfer feed operation on a variety of work—to change over from one job to another with a minimum of effort. Stampings manufacturers have, in the past, looked on special purpose transfer feed presses as potential white elephants due to their highly specialized function. These manufacturers will find in Transflex, an automated press designed to keep pace with design and model changes. Transflex is, in fact, so versatile that *contract stamping shops*, with their requirements for variegated production, are now taking advantage of the economies offered by Transflex operation.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

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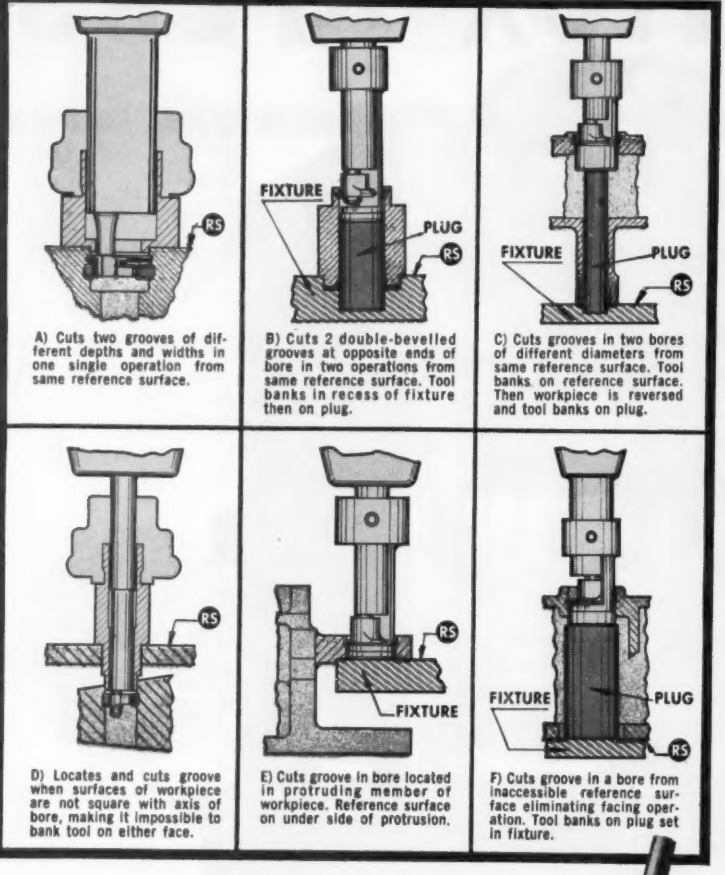
6499 W. 65th Street, Chicago 38, Illinois • Hamilton Division, Hamilton, Ohio

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

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Made by the Manufacturers of Waldes Truarc Retaining Rings
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Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

M058
Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.
Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)
Name
Title
Company
Address
City Zone State

Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Thor Power Tool Co., Aurora, Illinois
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOLLIES

Mighty Mover Co., 1482 S. Milwaukee St., Denver 10, Colo.

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

DRIFTS, DRILL

Armstrong, Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Buhr Machine Tool Co., Ann Arbor, Michigan
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakewood Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

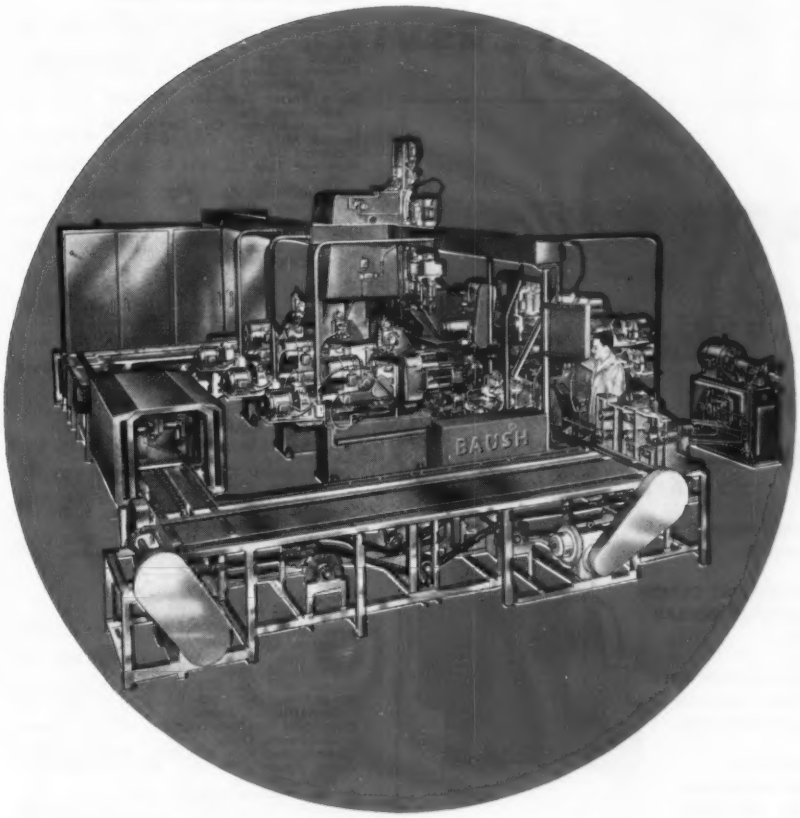
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill

(*Continued on page* 308)

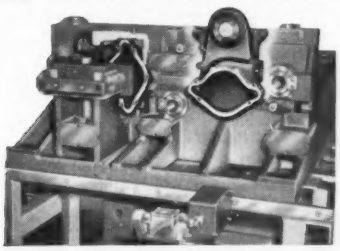
Your Production can be Increased with

BAUSH AUTOMATIC

Multi-Spindle Machine Tools



The Transfer is made up with — 5 Horizontal Model "S" mechanical leadscrew units, one of which is arranged with swivel to raise milling cutter from work • 1 Vertical Model "S" mechanical leadscrew unit • 2 Horizontal hydraulic units • 8 Fixed center heads with a total of 39 spindles • Single bar transfer mechanism • 5 Holding pallets with part held in 2 positions • Pallet conveyor • Electrical controls to J.I.C. Standards • 18 Motors



Automatic machines similar to the one illustrated more than pay for themselves through increased production at lower cost and with far less "down time" resulting from change overs, maintenance, etc.

Baush designed and built this 8-position, 4 station Transfer to drill, counterbore, countersink, chamfer, rough and finish bore, ream, face and turn 60 Chain Case Covers per hour at 100% efficiency for a leading engine manufacturer.

Why not let us show you how to adapt automatic tools and automation to increase your plant production.
There is no obligation in talking it over.

Write, wire or 'phone us — we'll gladly discuss your problems.

BAUSH machine tool co.
SPRINGFIELD 7, MASS.

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DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mach., Co., 26 Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Machine Tool Co., Ann Arbor, Michigan
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Stripper Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co. Inc., West Hartford, Conn.
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DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Machine Tool Co., Ann Arbor, Michigan
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
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(Continued on page 310)

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- GRINDING ON SINGLE POINT CARBIDE TOOLS REQUIRES SECONDS INSTEAD OF MANY MINUTES.
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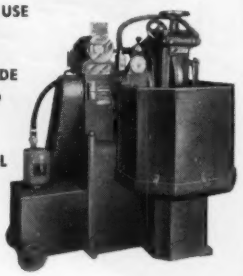

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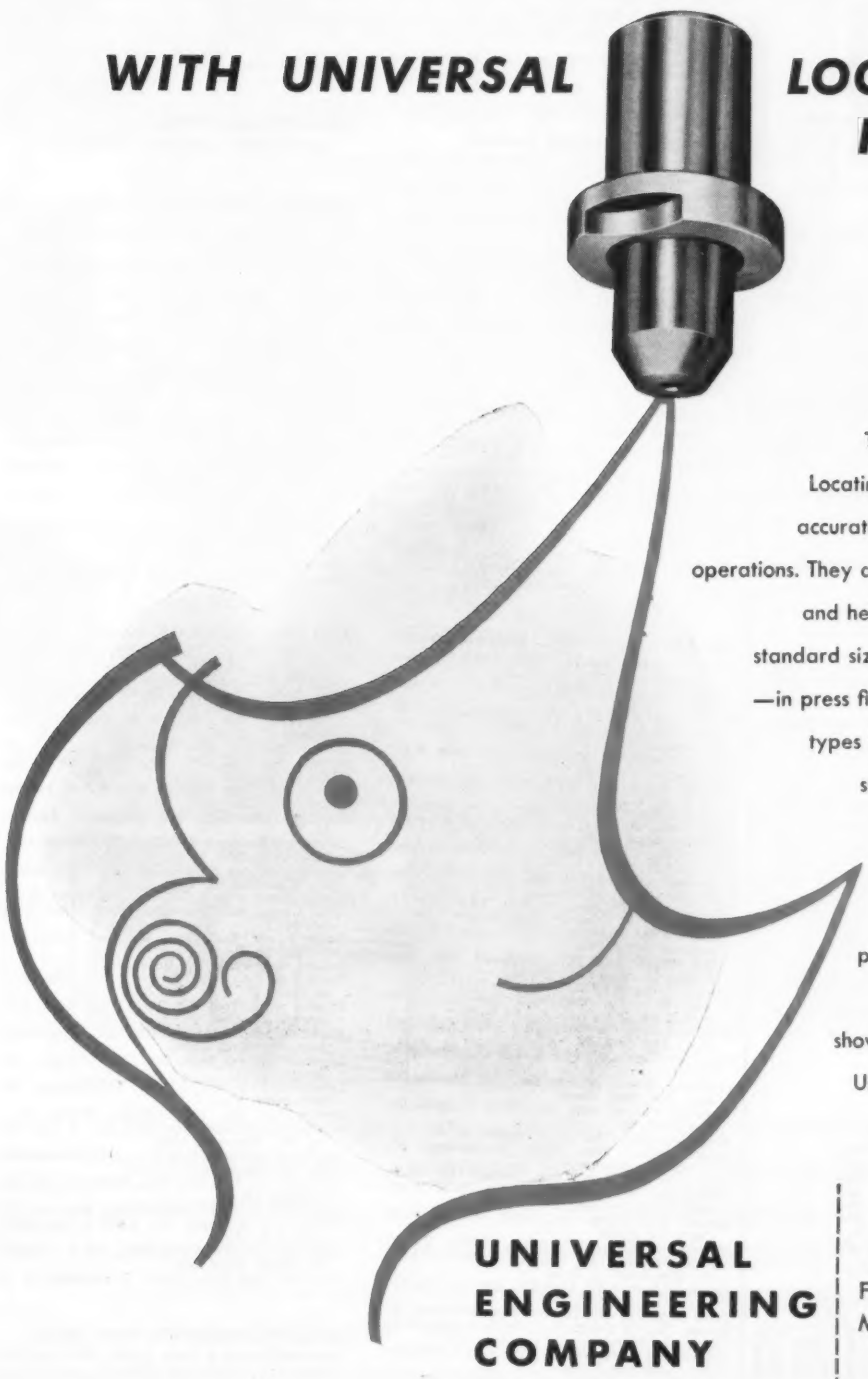

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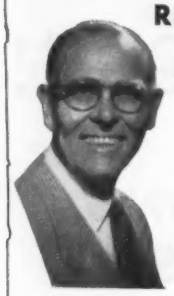

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Any job involving a large amount of responsibility is exacting. While I do not claim that mine is the toughest, I can say that the rigid policy set down by our management requires constant diligence and effort.

It is the policy of The Cincinnati Gear Company to make a delivery promise to the customer that there is every reason to expect will be fulfilled. The customer has a right to receive accurate information concerning the anticipated shipment of his order, and he also has a right to expect that promise to be fulfilled. It is the job of my department to operate our *new production scheduling system* in such a manner that accurate delivery promises can be given, and at the same time prevent the lead time from being ridiculously long. It is gratifying to state that we have failed to meet schedules only in a very limited number of instances, and many times have been successful in helping customers who, for some reason or another, found themselves in a real jam.

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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

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Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Machine Tool Co., Ann Arbor, Michigan
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
H. P. Townsend Mfg. Co., Elmwood, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 312)

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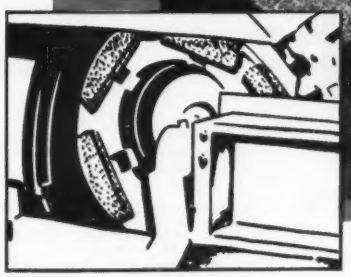

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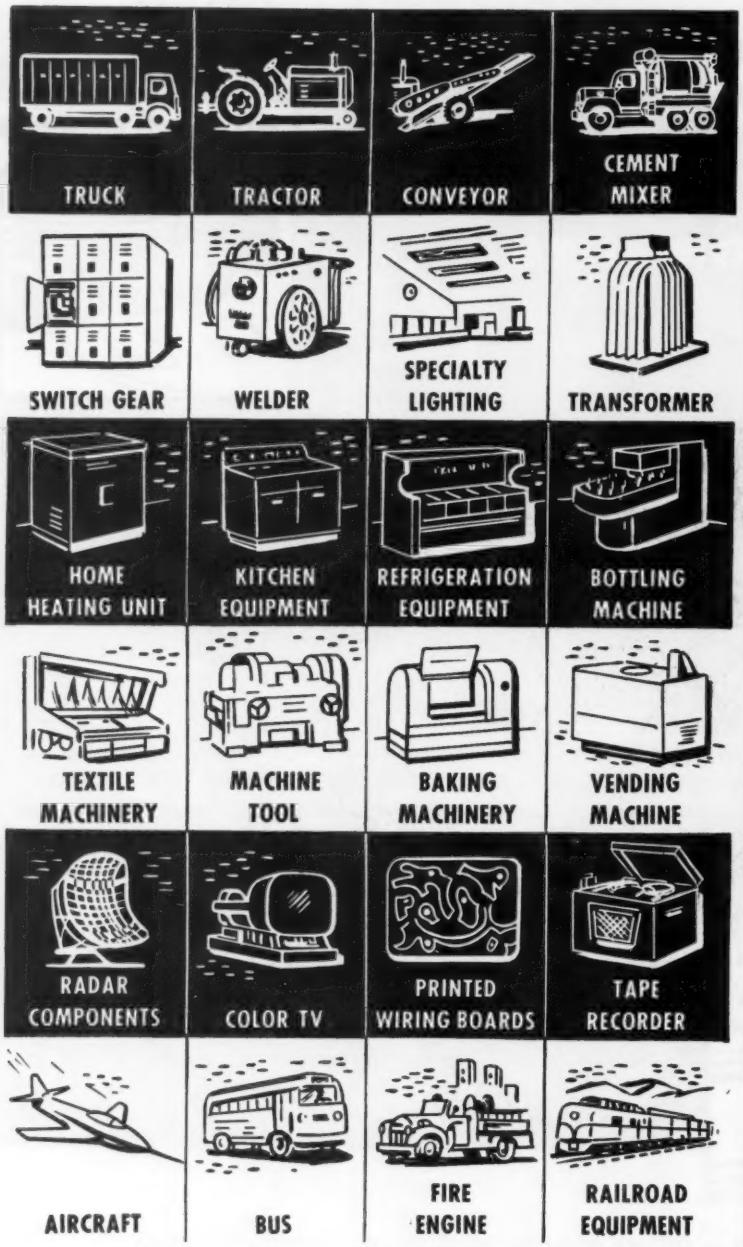

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL, Core
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Rachet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland
Ace Drill Corp., Adrian, Michigan.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
(Continued on page 314)

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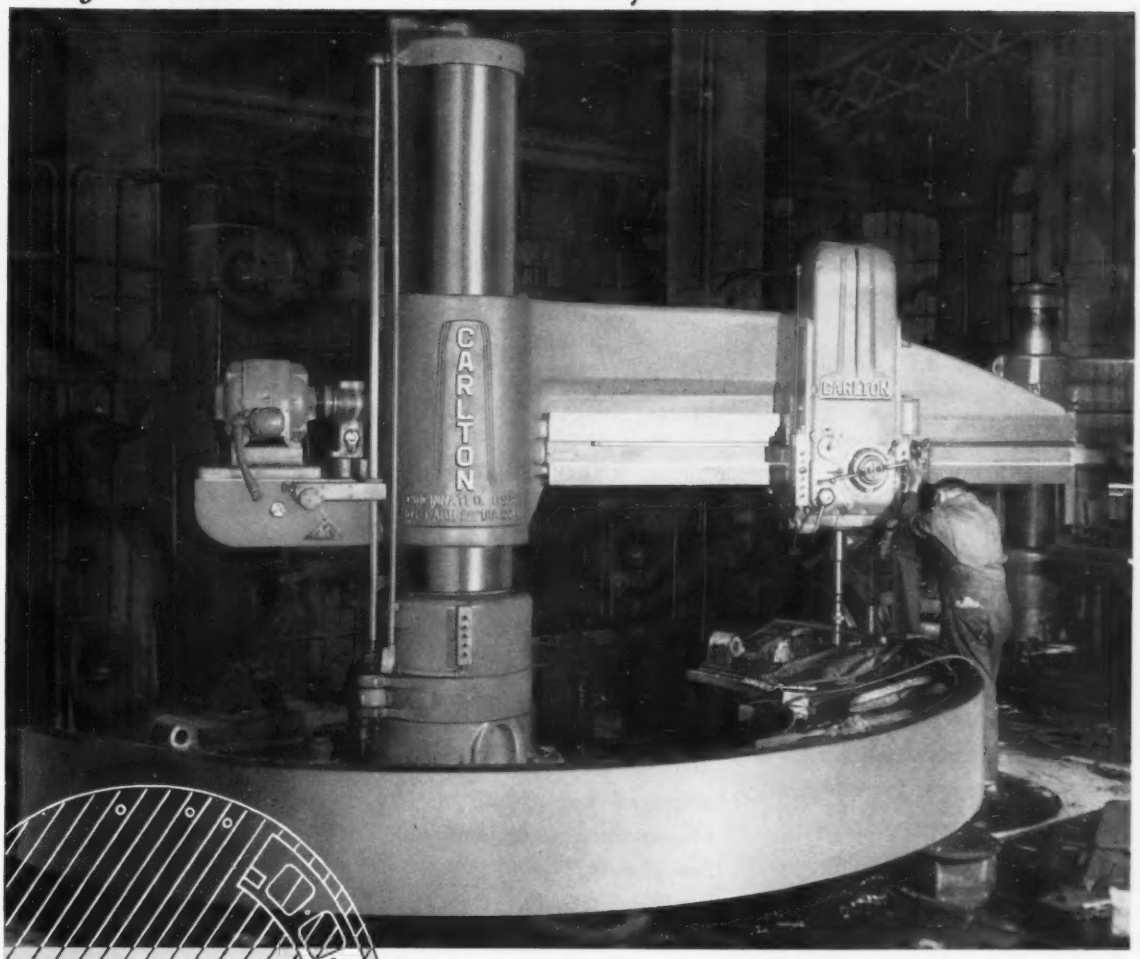

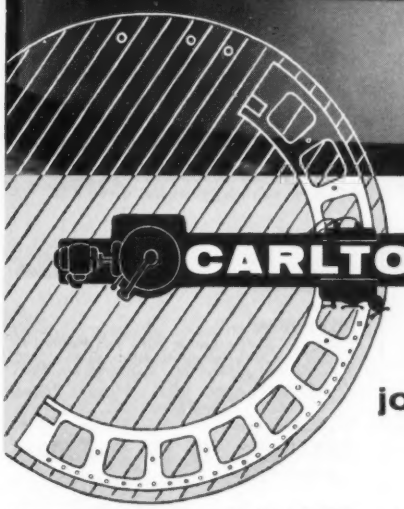

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Penna.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel

EMERY WHEELS

See Grinding-Wheels

END MILLS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

(*Continued on page* 316)

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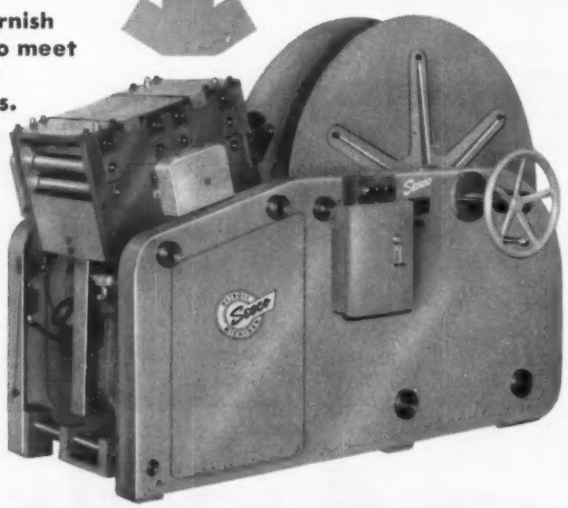

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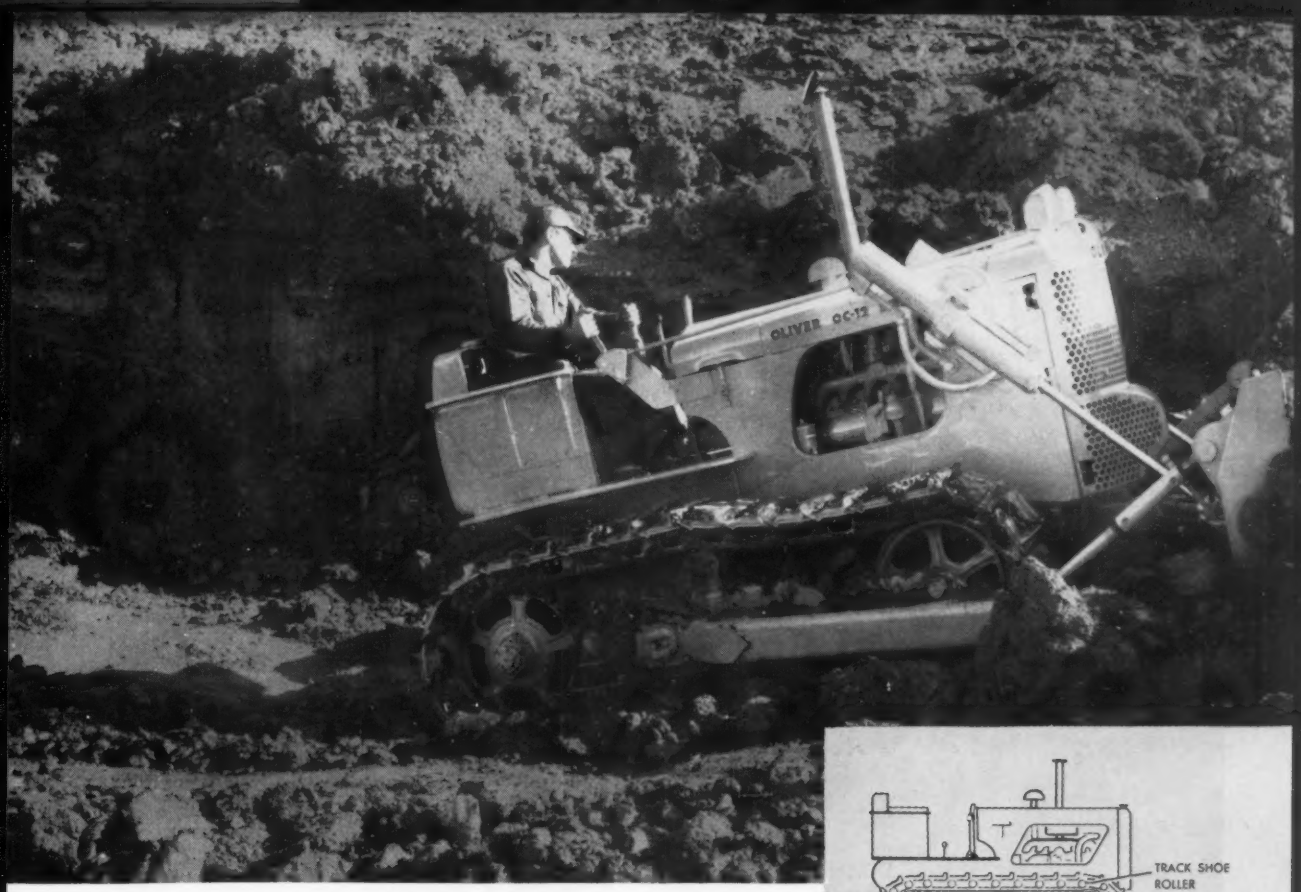

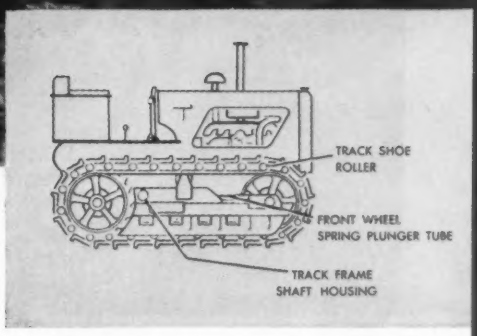

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In this powerful Oliver OC-12 Bulldozer, the following parts are fabricated from Shelby Seamless Mechanical Tubing — track shoe rollers, front wheel spring plunger tubes, and the track frame shaft housing. The chief qualifications possessed by these parts are high strength and superior wearability . . . qualities that are just right for a heavy-duty tractor application.

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FORGINGS, Machines (Upsetting)
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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Chambersburg Engrg. Co., Chambersburg Pa.
Cincinnati Shaper Co., Elam and Gerrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating
Ajax Electric Company, Philadelphia, Pa.
General Electric Co., Schenectady 5, N. Y.

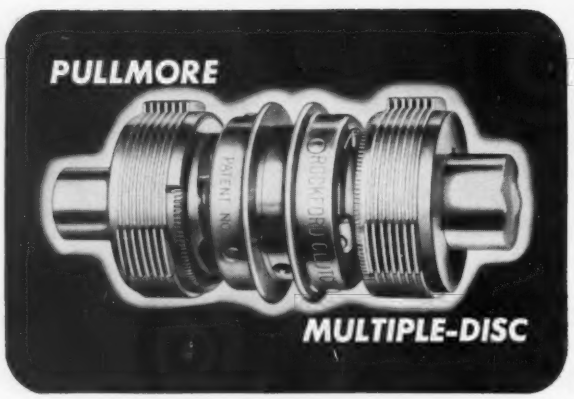
FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

(*Continued on page* 320)

ROCKFORD



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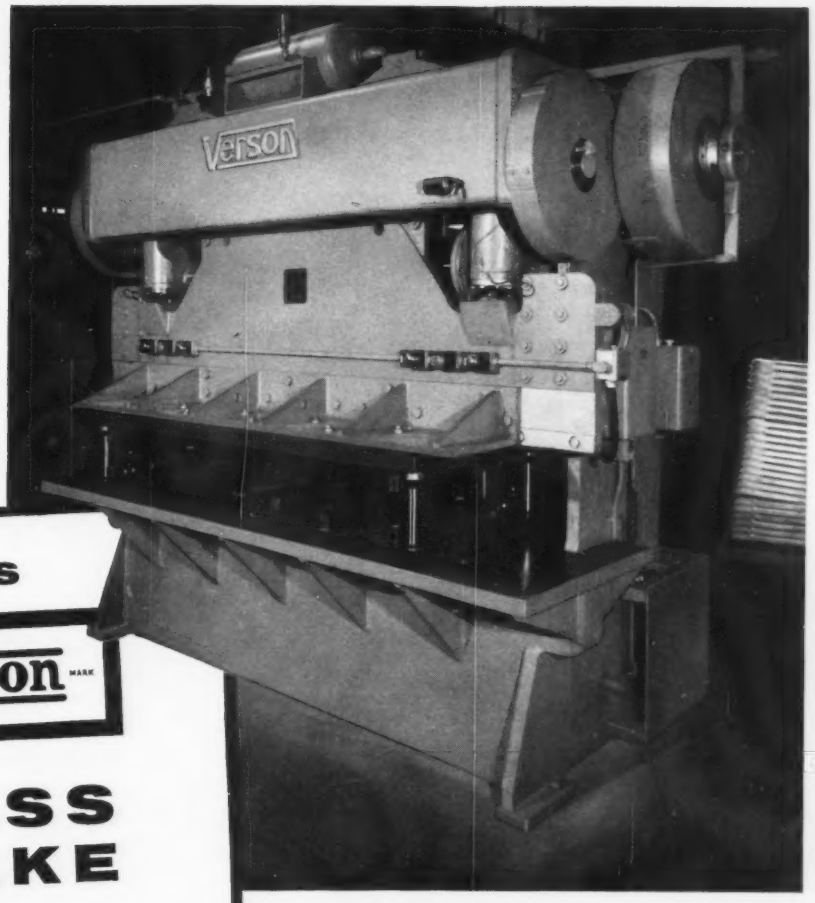

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. . . combines multiple production operations for TEMCO

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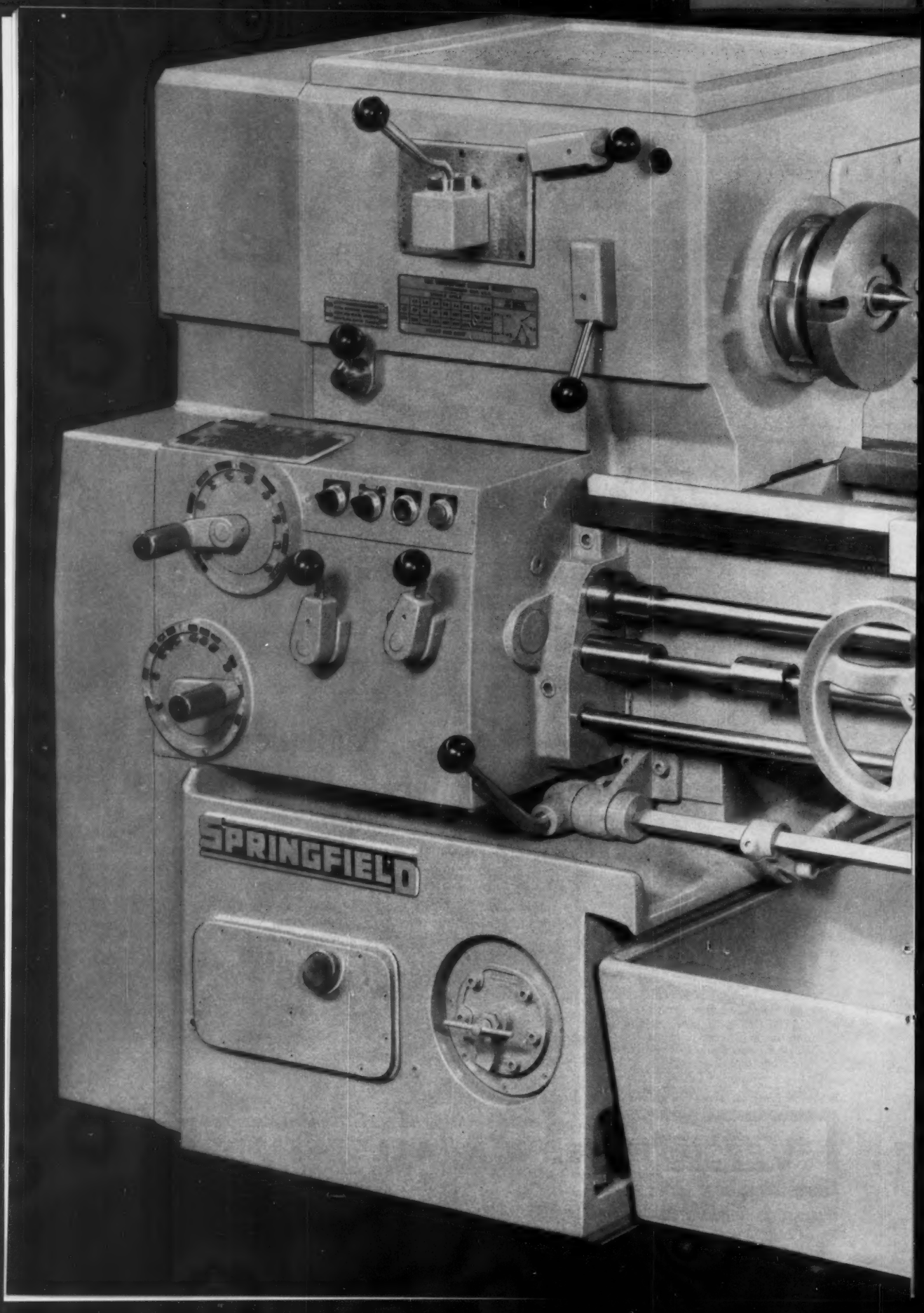
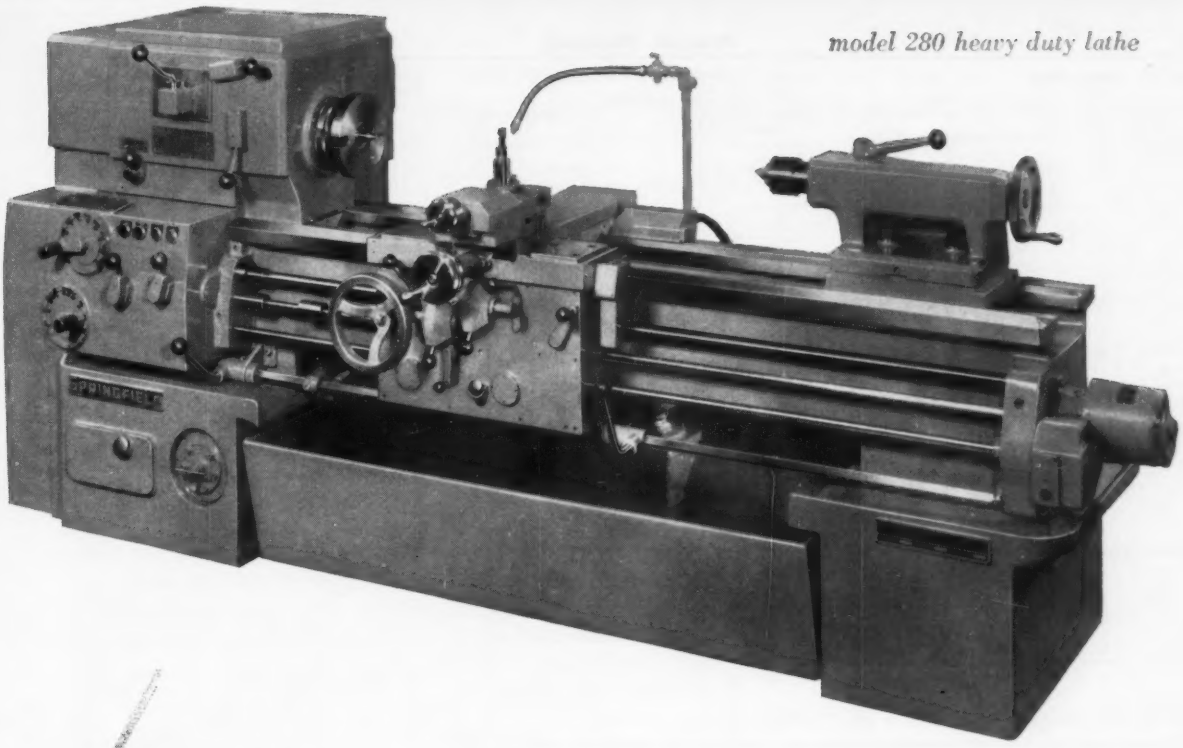

SPRINGFIELD



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Springfield, Ohio

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Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 17, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Thread

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co. Inc., West Hartford, Conn.
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(*Continued on page* 322)

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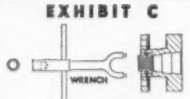

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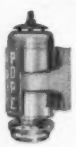

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EXHIBIT F

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EXHIBIT G

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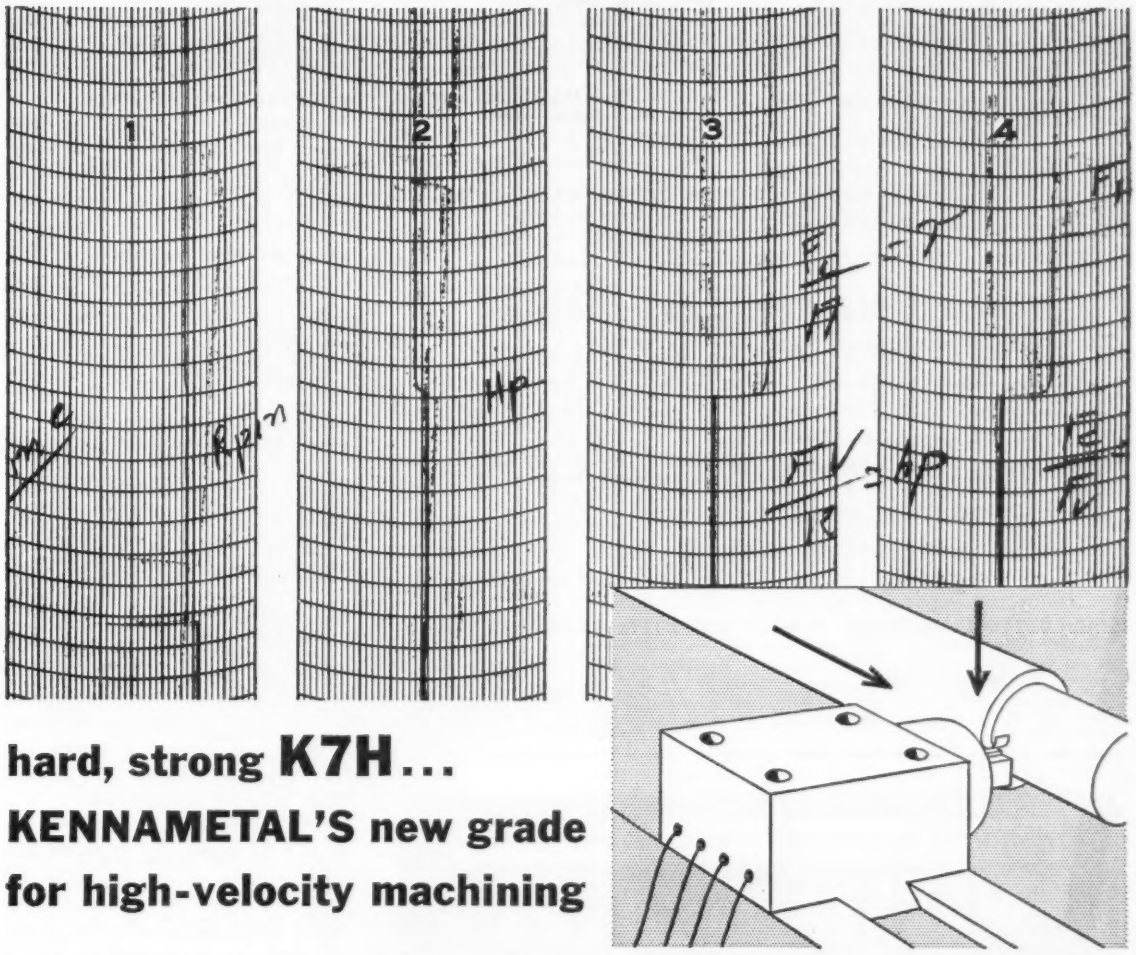

hard, strong K7H... KENNAMETAL'S new grade for high-velocity machining

In lab and shop tests, Kennametal* Grade K7H has proved to be a real "work horse" for high-velocity machining.

It's a genuine carbide—the hardest ever offered by Kennametal (93.5 Rockwell A).

It's strong—two to three times the strength of non metallic cutting materials . . . strength to resist chipping and cratering . . . strength to trace and cut to a shoulder . . . strength to stand up to normal shop abuse without "babying."

It's versatile . . . has the stamina to cover the range of feeds and depths of cuts for modern high-velocity finishing of steel alloys and the new hard-to-cut materials. Grade K7H even takes casting "skin" and forging scale in stride on light cutting—another indication of its strength and stamina.

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Compared with other carbides at high velocity, Grade K7H showed these results: *Test No. 1* (without coolant) —K7H performance, cutting 29-32 Rockwell C steel, indicated 27 times longer life; *Test No. 2* (with coolant) —K7H showed 28 to 1 better performance (also on 29-32 Rockwell C materials) than the control carbide grade; *Test No. 3* (without coolant)—cutting 37-39 Rockwell C steel, Grade K7H showed considerably higher resistance to wear than other carbides.

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Compared with non metallics, and long-established carbides on high-velocity finish machining of SAE 5135 170-207 Bhn., Grade K7H averaged 1000 gears per cutting edge while other carbides produced only 350 pieces, and ceramics broke down at 400-450 per edge.

These tests show that Kennametal Grade K7H is truly the "work horse" for high-velocity machining as we know it today. Why not ask a Kennametal tool engineer to demonstrate Grade K7H in your operations. Or write for complete information. Address KENNAMETAL INC., Latrobe, Pennsylvania.

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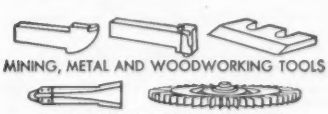

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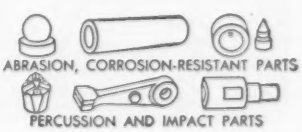


Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd. Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks, 1309 So. Cicero Ave., Chicago 50, Ill.
Cincinnati Gear Co., Wooster Pike and Miemont Ave., Cincinnati, Ohio
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(*Continued on page* 324)

Another of the Reasons Behind Brad Foote Quality—

METALLOGRAPHY

• The heat treatment a gear receives is probably the most important single factor in determining its long range wear characteristics. Here at BRAD FOOTE we pride ourselves on having equipment designed to provide the widest possible variety of heat treatments.

• But in addition to standard heat treating and testing equipment we have a few extra safeguards. One of these, rather unusual in our business, is a complete Metallographic laboratory. Specialized equipment allows us to examine or photograph the grain structure of all of our metals, in order to determine the most effective methods of heat treatment and to serve as a check on the quality of finished work.

• Metallographic examination is just one of the many reasons behind BRAD FOOTE quality. Prove to yourself the savings this extra quality can mean. Let us quote on the gear requirements for your next program, without obligation.

BRAD FOOTE MAKES ALL TYPES OF GEARS—IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.

1309 South Cicero Avenue - Cicero 50, Illinois
Bishop 2-1070 - OLympic 2-7700 - TWX CIC-2856-U

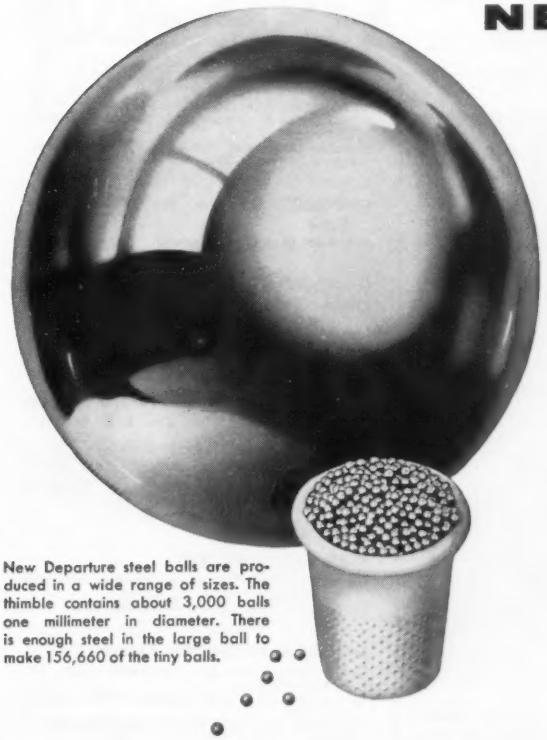
subsidiaries
AMERICAN GEAR & MFG. CO. Lemont, Illinois - Phone Lemont 920
PITTSBURGH GEAR COMPANY Pittsburgh 25, Penn. - Phone SPalding 1-4600

FACTS

about

NEW DEPARTURE

STEEL BALLS



New Departure steel balls are produced in a wide range of sizes. The thimble contains about 3,000 balls one millimeter in diameter. There is enough steel in the large ball to make 156,660 of the tiny balls.

Available in any quantity to fit your specifications for grade, size and accuracy!

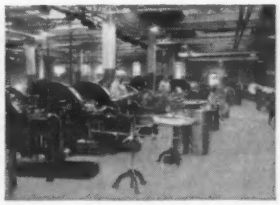
When industry wants steel balls of proven accuracy and dependability, it is only natural that they turn to New Departure, leading producer of ball bearings and therefore thoroughly experienced in the manufacture of precision balls. Today, New Departure provides industry with high-carbon chrome and stainless steel balls in a wide range of sizes and specifications.

New Departure balls are produced from the finest high-carbon chrome steel. AISI Type E51100 steel, specially made for New Departure, is heat-treated to achieve the proper hardness and toughness for maximum strength and life in the finished product. Stainless steel, AISI Type 440C, used by New Departure results in balls of much improved hardness and load-carrying ability.

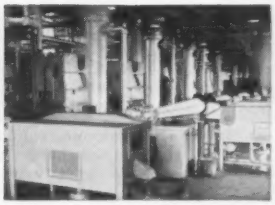
In addition to producing the finest steel balls available, New Departure will fill volume orders for balls of special materials such as high-nickel or cobalt-base alloys, tool steel and others.

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

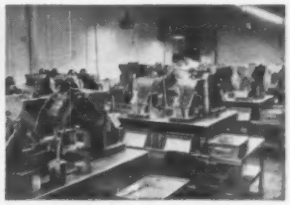
Steel ball wire is drawn through dies to assure uniform diameter and roundness.



Precise control of grain flow is obtained with these Ball Heading Machines.

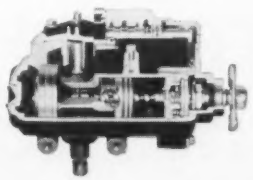


Balls are heat-treated, quenched in oil or water, then tempered in electric furnaces.



These gauges sort balls into lots according to required diameter limits.

Applications range from power steering to pencils



The unique advantages of New Departure steel balls are utilized in many applications ranging from heavy-duty bearings to the new liquid lead pencil. To accommodate these applications, New Departure steel balls are offered in sizes ranging from .025 inch to 1⅞ inches in diameter.

New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cincinnati Gear Co., Wooster Pike and Marlcmont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

GEARS, Stamped

Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

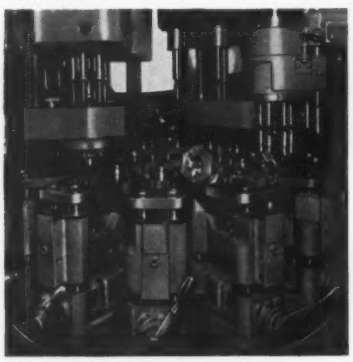
MILLHOLLAND

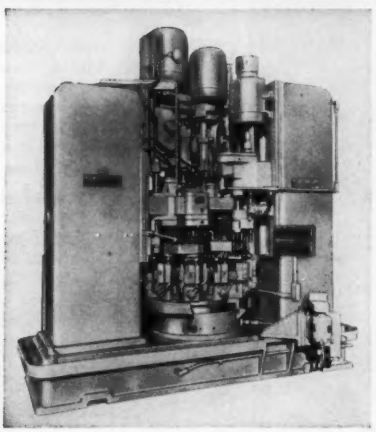
12-Station Vertical Indexing Machine

34 Spindles!

93 Pieces per Hour!

Here is Millholland versatility in action!





Unique Holding Fixture

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Part requirements dictated location using self-centering horizontal vees with upacting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

Write for Bulletin M-5 giving further details.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches., Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Illinois

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thor Power Tool Co., Aurora, Illinois

GRINDING FIXTURES

Geometric Tool Co., (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sterling Grinding Wheel Co., Tiffin, Ohio
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

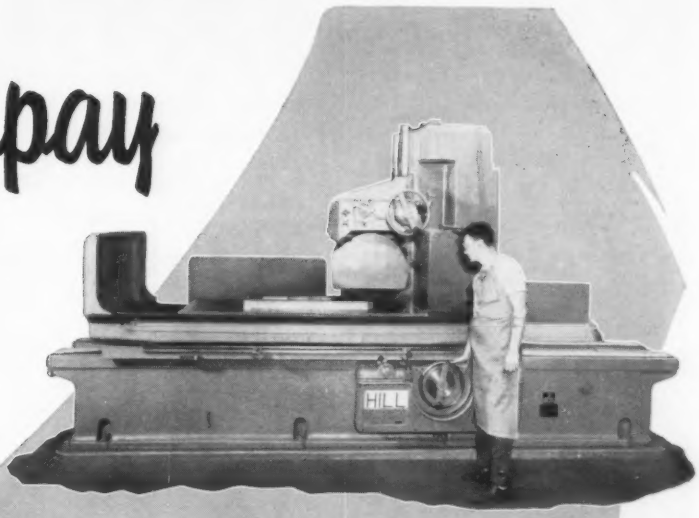
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

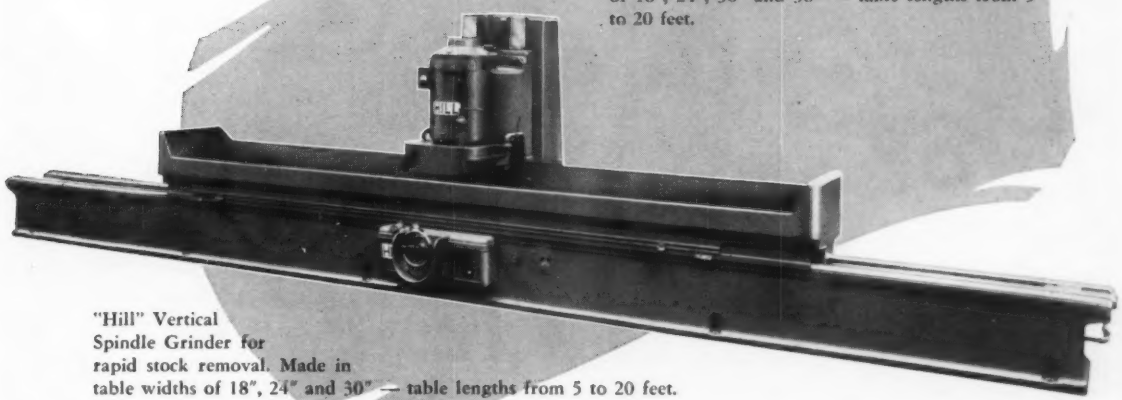
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page* 326)

It should pay you too!



"Hill" Horizontal Spindle Grinder for a wide range of precision grinding. Made in table widths of 18", 24", 30" and 36" — table lengths from 5 to 20 feet.



"Hill" Vertical Spindle Grinder for rapid stock removal. Made in table widths of 18", 24" and 30" — table lengths from 5 to 20 feet.

Every manufacturer of heavy duty precision surface grinding equipment has:

- √ **Testimonials from satisfied users.**
- √ **Records of fine finishes produced.**
- √ **Case histories of phenominal savings over other finishing methods.**

But there are other important factors that should be considered:

- √ **Maximum accessibility and control simplicity.**
- √ **Minimum maintenance over the years.**
- √ **Longer accurate production life due to proven design methods, rigid construction and vibration-free operation.**

It has always paid the users of HILL Open Side Hydraulic Surface Grinders. It should pay you too!

Look for the added considerations before you buy!

THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

For more information fill in page number on Inquiry Card, on page 219

GRINDING MACHINES, Carbide Tool

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Centerless

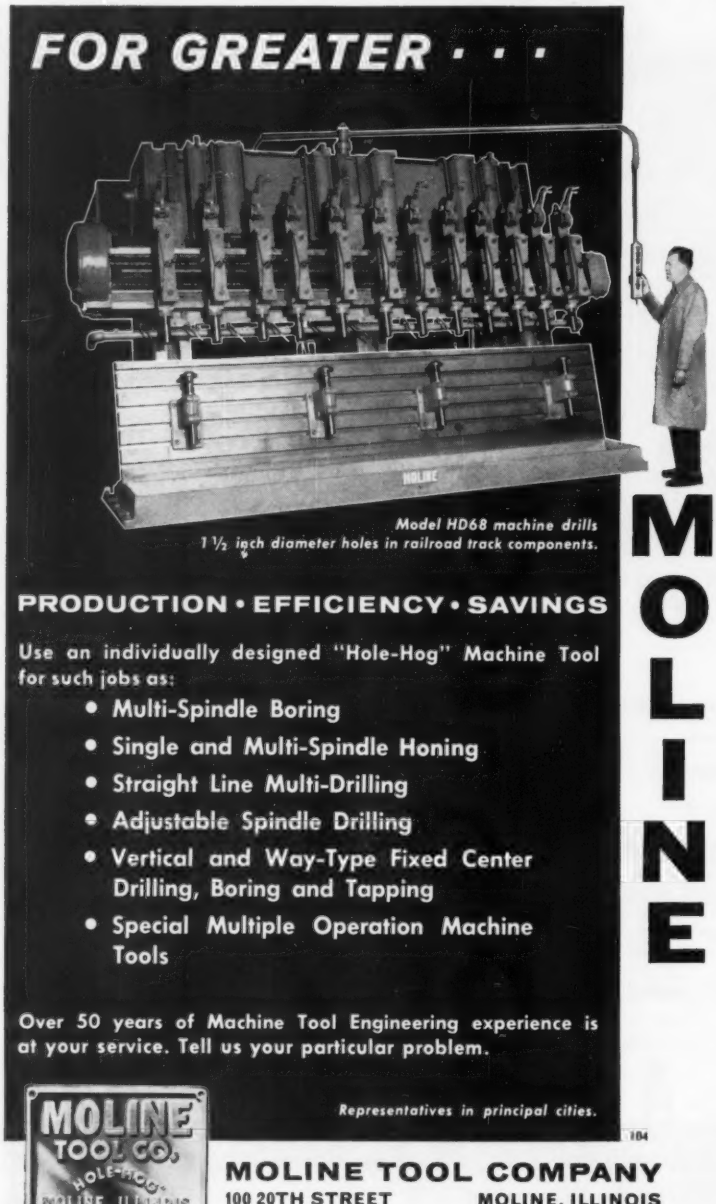
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.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MOLINE
Model HD68 machine drills 1 ½ inch diameter holes in railroad track components.
PRODUCTION • EFFICIENCY • SAVINGS
Use an individually designed "Hole-Hog" Machine Tool for such jobs as:
• Multi-Spindle Boring
• Single and Multi-Spindle Honing
• Straight Line Multi-Drilling
• Adjustable Spindle Drilling
• Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
• Special Multiple Operation Machine Tools
Over 50 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.
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GRINDING MACHINES, Cylindrical

Arter Grinding Mch Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Face

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

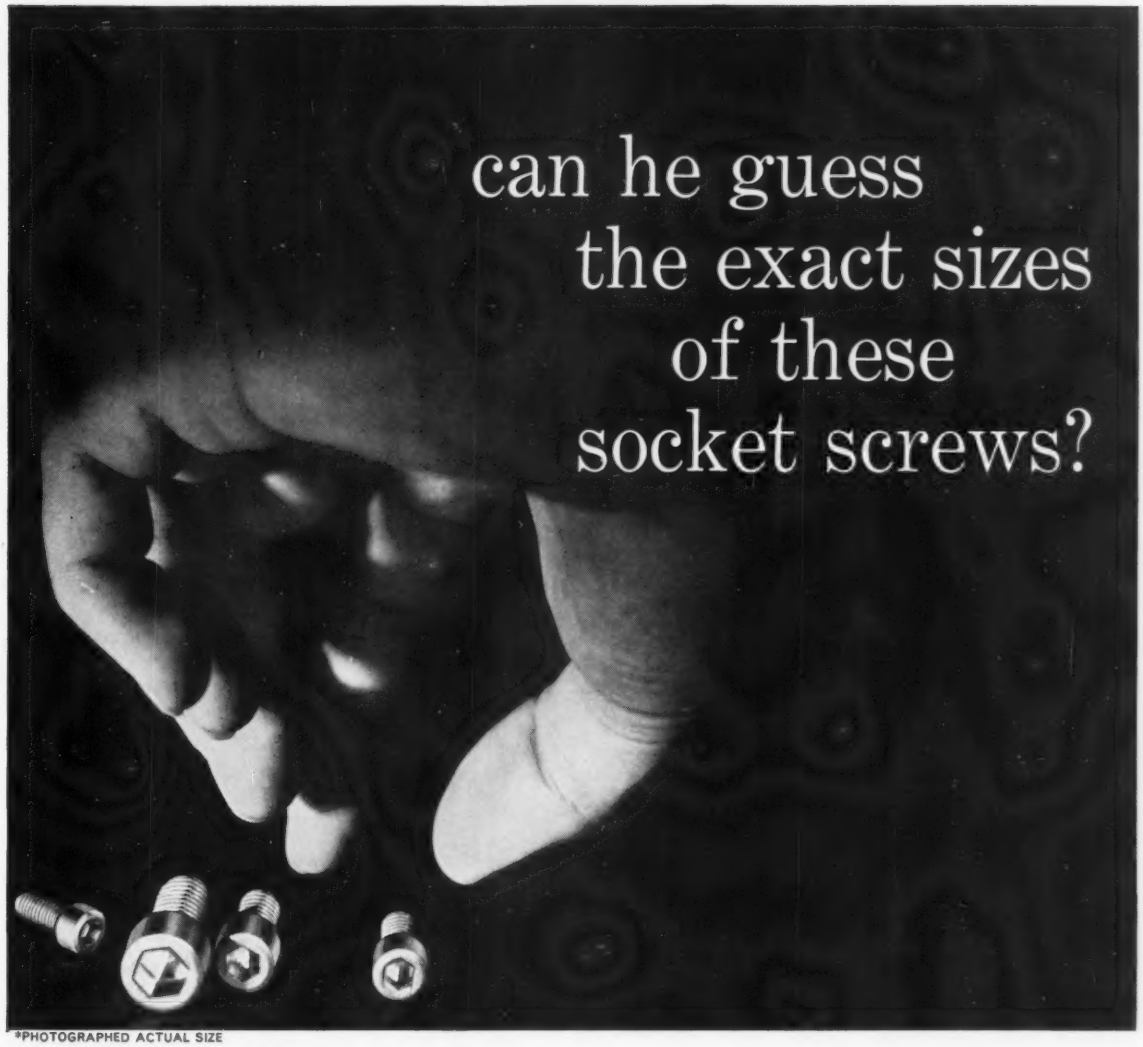
GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 524 N. Laurel Ave., Des Plaines, Ill.

(*Continued on page* 328)



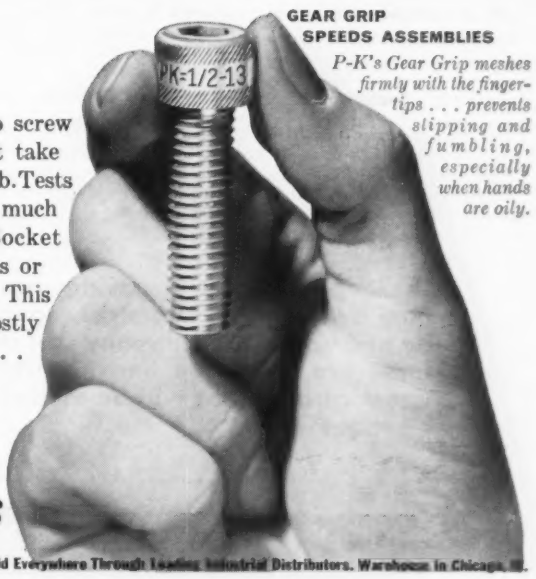
*PHOTOGRAPHED ACTUAL SIZE

Experts can usually tell the size of a socket head cap screw simply by looking at it. "Green hands", however, must take time out to "mike" before returning left-overs to the tool crib. Tests show that even some experienced workers guess wrong as much as half the time. With Parker-Kalon *Size-Marked* Socket Head Cap Screws on the job, there's no need to guess or "mike" for size. The size is clearly marked on the head. This exclusive P-K feature saves valuable time and eliminates costly errors. It's just one more reason why you can be sure . . . "if it's P-K, it's O. K."

*SIZES (L. TO R.) NO. 10, 3/8", 5/16", 1/4"

GEAR GRIP SPEEDS ASSEMBLIES

P-K's Gear Grip meshes firmly with the fingertips . . . prevents slipping and fumbling, especially when hands are oily.



PARKER-KALON® *fasteners*

Parker-Kalon Division, General American Transportation Corporation—Clifton, N. J. • Sold Everywhere Through Leading Industrial Distributors. Warehouse in Chicago, Ill.

For more information fill in page number on Inquiry Card, on page 219

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Waltham, Mass.

GRINDING MACHINES, Internal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2448-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co. Inc., West Hartford, Conn.

GRINDING MACHINES, Knife and Shear Blade

Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

The MODERN AUTOMATIC
CUTTING-OFF MACHINE

Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ⅛" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

WRITE FOR ILLUSTRATED CATALOG

MODERN MACHINE TOOL CO.
Jackson, Michigan

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

(*Continued on page* 330)

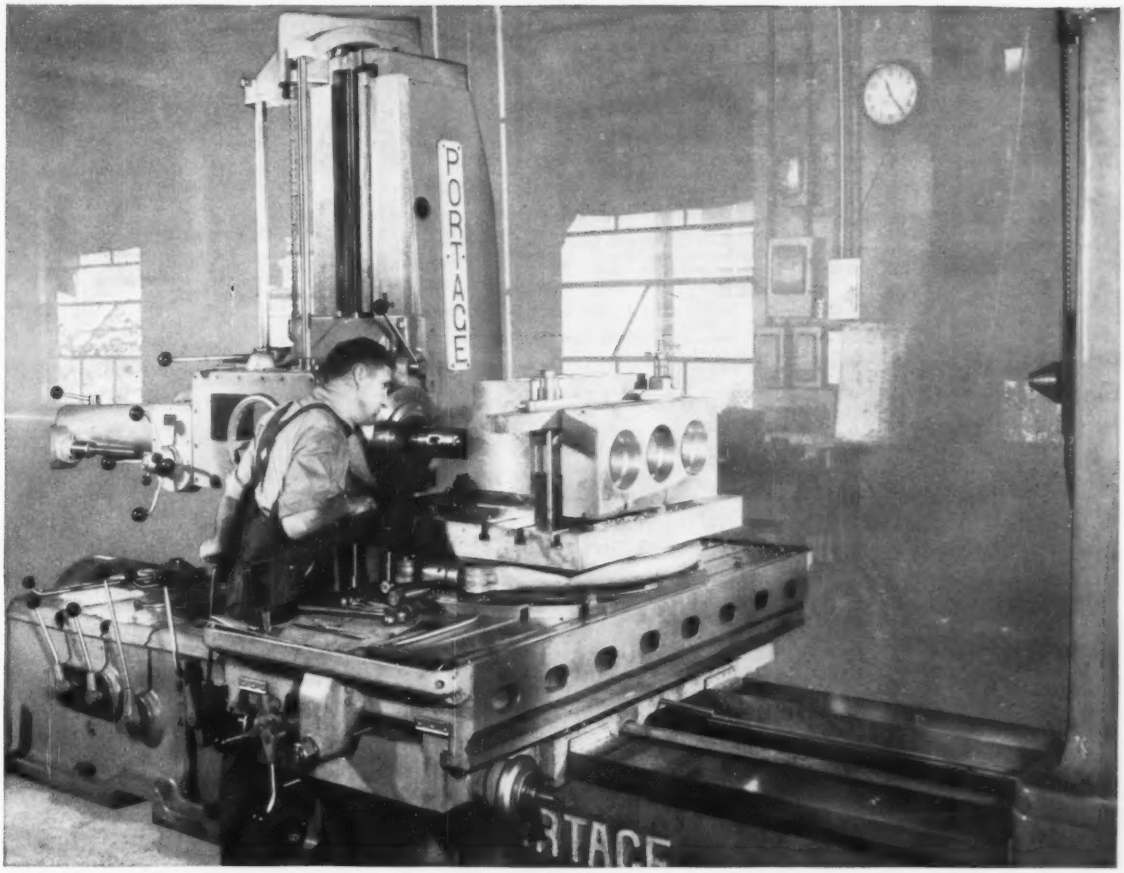
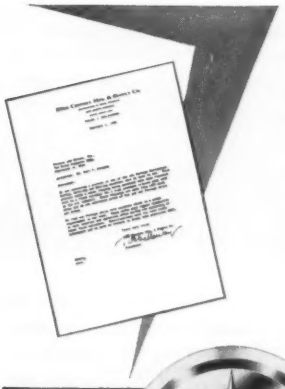


Photo courtesy 20TH Century Mfg. & Supply Co., Tulsa, Oklahoma

"We are extremely proud of the job our PORTAGE mills are doing"



The Portage Machine Co.
Akron, Ohio

Gentlemen:

Our business, as you know, is Contractors of Metal Products. This particular job is a steel forging being machined, and when finished will be a fluid cylinder for a high pressure pump used in the oil industry. These forgings are made from AISI-4140 steel and we are extremely proud of the job PORTAGE mills are doing.

We find our PORTAGE mills very accurate. These mills must repeat themselves in each location and operation often during the machining operation. Specifications call for very close tolerances and we have no trouble in doing this precision work.

Yours truly,
20TH Century Mfg. & Supply Co.

R. G. Galloway
President

THE Portage MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio
Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

For more information fill in page number on Inquiry Card, on page 219

GRINDING MACHINES, Thread

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Universal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING WHEELS

Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal

Spiral Step Tool Co., Chicago 25, Ill.
Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric

Millers Falls Co., Greenfield, Mass.
Thor Power Tool Co., Aurora, Illinois

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Shaft

Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

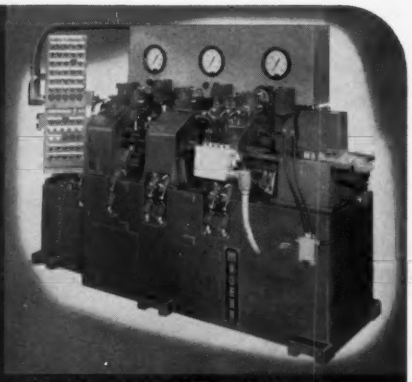
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols, Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 332)

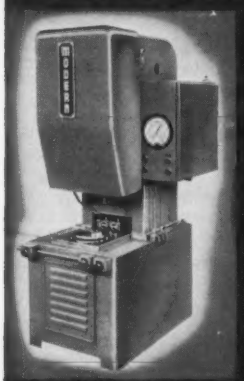
Production Pressure Test for AUTOMOTIVE AIRCRAFT APPLIANCE and FARM EQUIPMENT Industries



Transfer unit checks 133 manifolds per hour

Here are a few features of Modern pressure test units now in service:

- Fully automatic transfer line operation testing three separate manifold passages including marking of O.K. parts. Defectives are automatically color coded to show reason for rejection and shuttled to rework station.
- Semi-automatic checking of transmission converter and end housings including stamping of O.K. parts. Production up to 58 parts per hour.
- Semi-automatic inspection of cylinder heads including automatic "dunking" of defective parts to locate leaks.



Model MPT-1 unit for transmission converter housings

Ask for literature describing Modern's pressure test units.

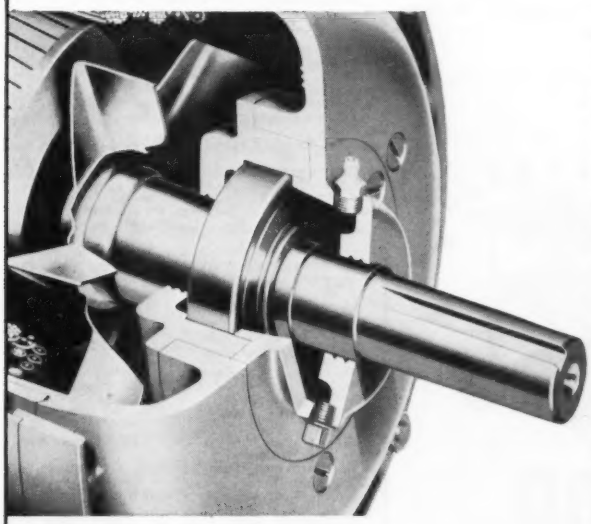
MODERN® Industrial Engineering Co.

14230 BIRWOOD AVE. DETROIT 38, MICHIGAN

PLUS values in power

BEARING PROTECTION is double

in HOWELL series one hundred motors to give you



LONGER MOTOR LIFE

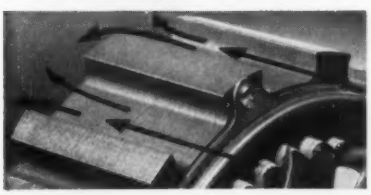
LESS MOTOR MAINTENANCE

When you are specifying motors in the new frame sizes, look at the bearings — they're an important yardstick of motor life and ease of maintenance.

Bearings on Howell Series 100 motors have these double protections: (1) On TEFC motors, bearing cartridge seals out dirt and dust, even when motor is disassembled for servicing. (2) Double-shielded bearings insure that any grease contamination is kept out of the races.

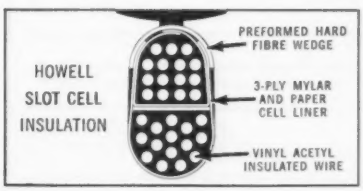
Over-lubrication is virtually eliminated to remove a common cause of bearing failure. With the Howellube system, grease enters and exits on the same side of the bearing — balls are never packed tight by through-flushing. Compare them all . . . then buy the best!

GET THE PLUS values THAT COUNT....specify HOWELL series 100 motors



heat-source ventilation

Wide slots in the stator provide 50% more contact between cooling air and stator laminations, main source of motor heat. Cool running Series 100 motors last longer.



mylar insulated to stand the gaff

Mylar* — for top moisture resistance and 8 times the dielectric strength of paper insulation — protects Series 100 windings under the worst of operating conditions.

*Dupont trademark

smaller, lighter, better looking

Save machine and storage space, save shipping weight, and get new functional streamlining that matches the motor to your most modern machine design or production equipment. Why put up with dust catching fins on a motor, when sleek good appearance costs no more.

For more details on Series 100 motors, write for Bulletin N-100-R

HOWELL Red Band MOTORS

HOWELL MOTORS

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

For more information fill in page number on Inquiry Card, on page 219

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., Dept. M. First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen Co., Dept. M. First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen Co., Dept. M. First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., Dept. M. First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS
Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

5603

NOW!

NEW Convenience
NEW Capacities
NEW Designs

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table

NEW provision for increasing table area!

NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 834 South Ninth Street, Hamilton, Ohio.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharp Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER

See Boring Machines, Jig

JIGS AND FIXTURES

Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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Gleason Works, 1000 Unviersity Ave., Rochester, N. Y.
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LATHES, Bench

Levin, Louis, & Son, Inc., Los Angeles, Calif.

LATHES, Boring

Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio

(*Continued on page 334*)

5203-R

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Springfield Mch. Tool Co., Springfield, Ohio.

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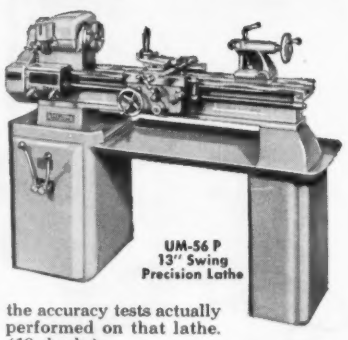

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13" Swing
Precision Lathe

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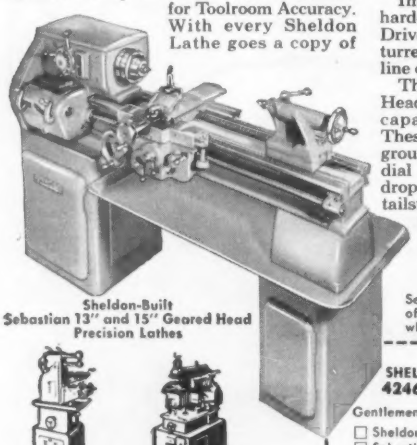

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See Lathes, Engine and Toolroom

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Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
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(*Continued on page* 336)

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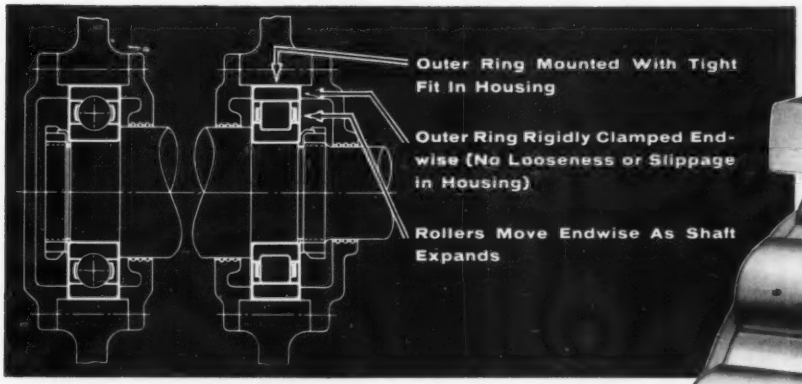
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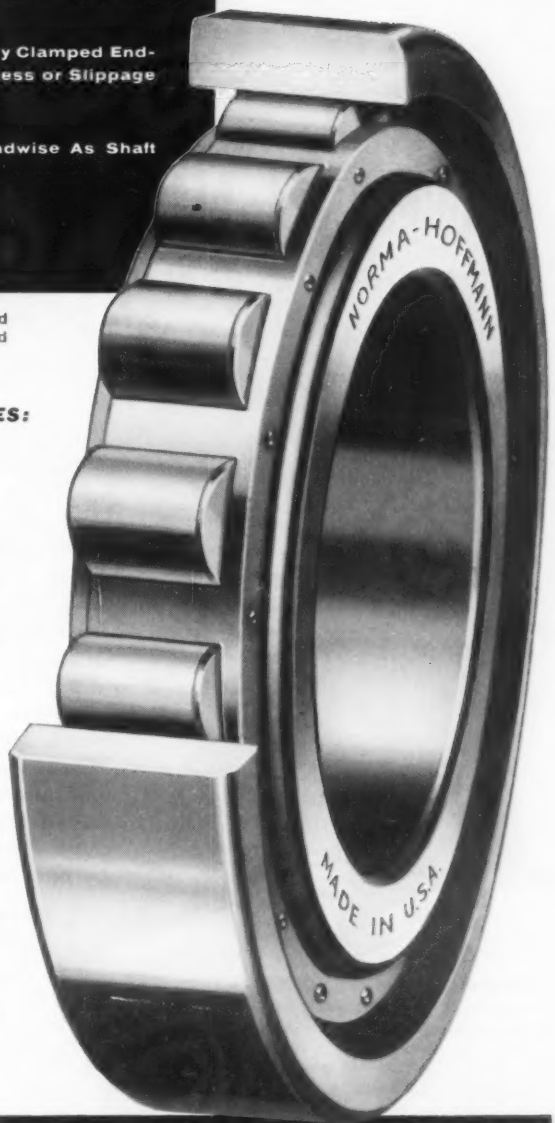
Outer Ring Rigidly Clamped Endwise (No Looseness or Slippage in Housing)
Rollers Move Endwise As Shaft Expands

Typical Mounting Using Clamped Ball Bearing At Lightly Loaded End Of Shaft And Clamped Roller Bearing At Heavily Loaded End



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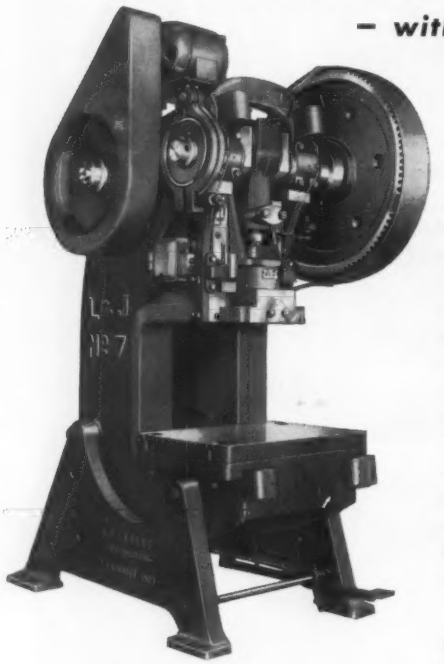

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Pratt & Whitney Co. Inc., West Hartford, Conn.
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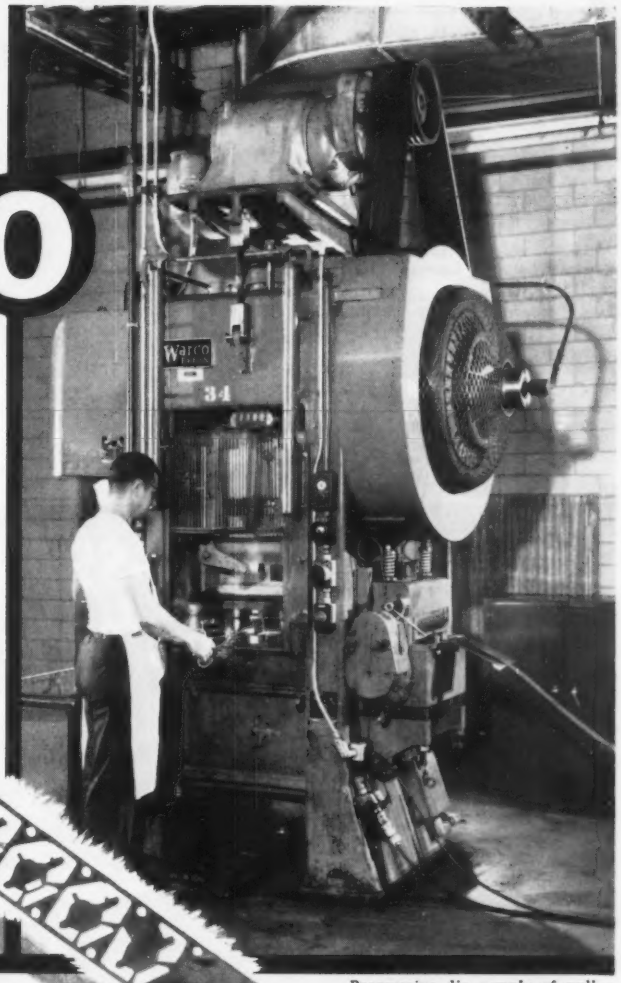
(*Continued on page 338*)

How Warco® PRESSES help Kodak make precision cameras



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Cine-Kodak Medallion 8

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The Federal Machine and Welder Company

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Consolidated Machine Tool Corp., Rochester, N. Y.
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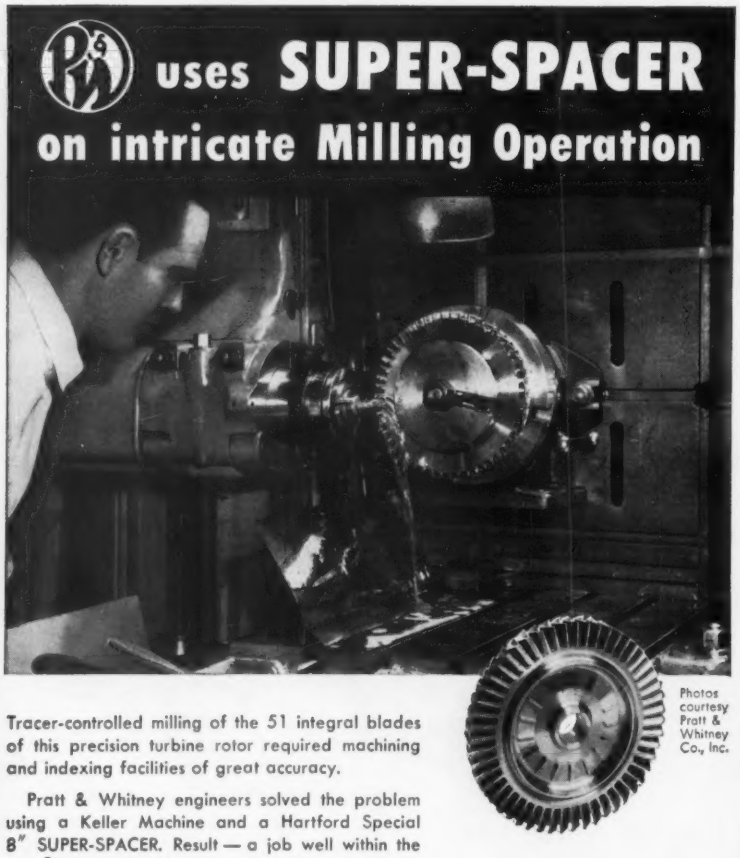
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

(*Continued on page* 340)



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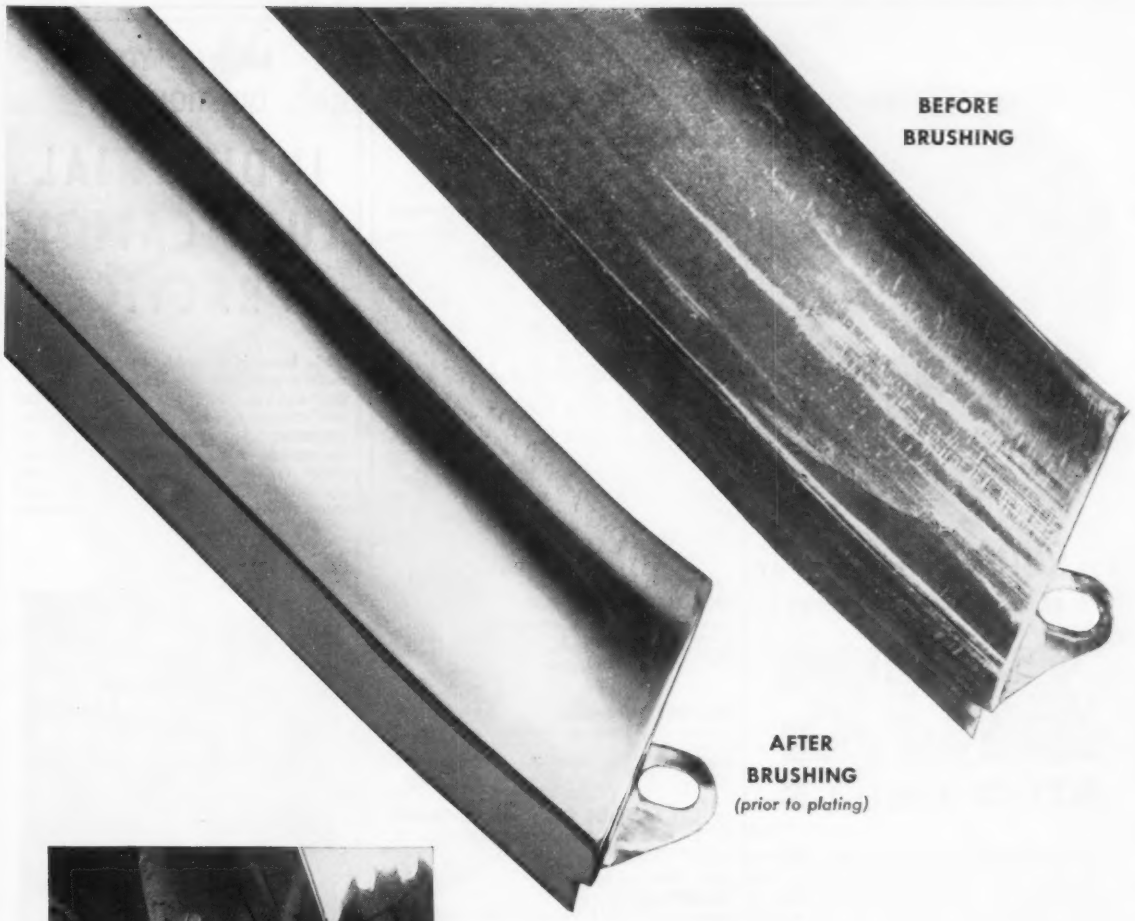

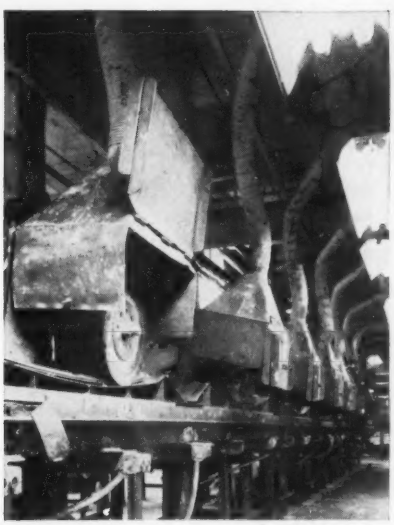

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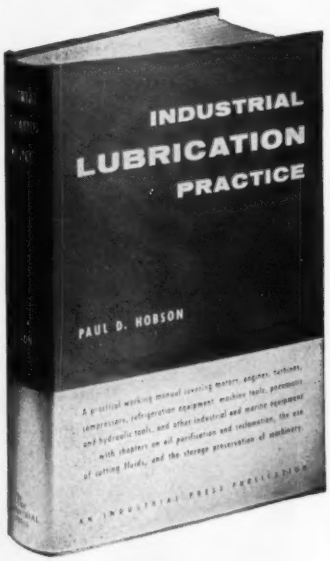

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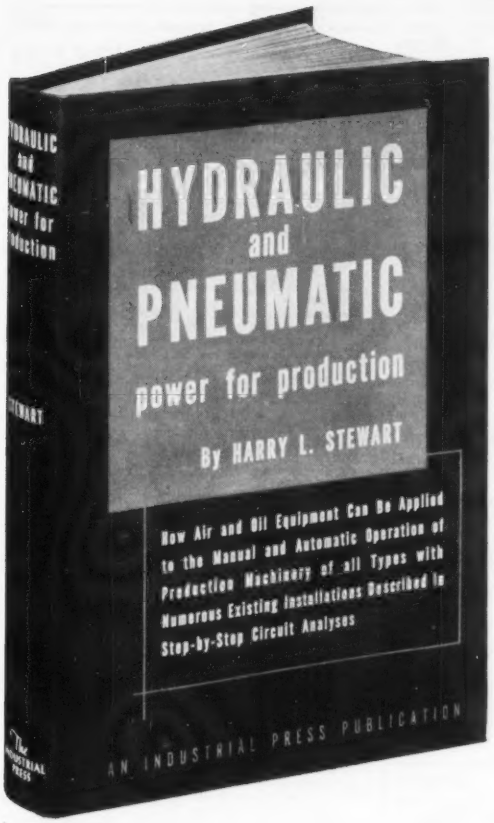
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Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton Ohio.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
Baldwin, Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio
Cleveland Punch & Shear Works Co., 3917 St Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y
Dake Corp., 604 Seventh St., Grand Haven Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Aves., Philidalphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Machine & Welder Co., Overland Ave Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1 N. Y.
Johnson Machine & Press Corp., Elkhart, Ind.
L & J Press Corp., Elkhart, Ind.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y

PRESSES, Straightening

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y
Dake Corp., 604 Seventh St., Grand Haven Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works (Hydraulic) 683 Northland Ave., Buffalo, N. Y.
Philips & Davies, Inc., 920 Steiner Ave Kenton, Ohio
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y
Cosa Corp., 405 Lexington Ave., New York 17 N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I

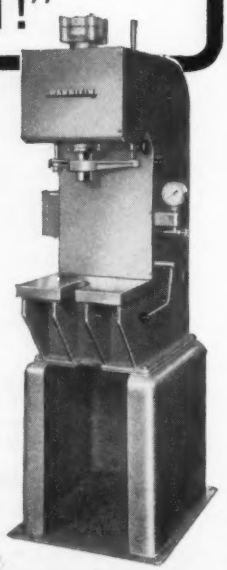
PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 1948-52 Ridge Ave., Evanston Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave. Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.

"BEST $1306 WE EVER SPENT!"



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Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharp Mfg. Co., Providence, R. I.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharp Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Ace Drill Corp., Adrian, Michigan.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co. Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Wesson Co., 1220 Woodward Heights Blvd. Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

REAMERS, Taper Pin

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass
Kaufman Manufacturing Co., Manitowoc, Wis
National Twist Drill & Tool Co., & Winter Bros Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Machine Tool Co., Ann Arbor, Michigan
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

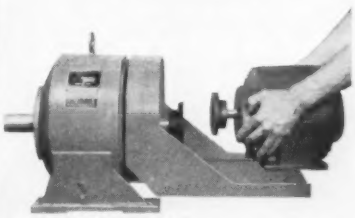
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

(*Continued on page 348*)

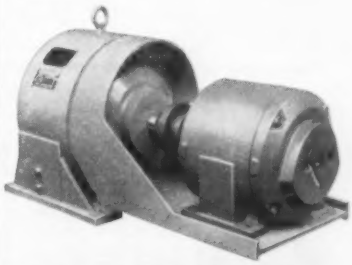
Change MOTORS ...in Minutes



...with the Phillie Gear UTILITY GEARMOTOR

Motors can be interchanged or replaced in a matter of minutes, merely by unbolting the old motor, separating the coupling halves, and bolting-on the new motor. No long and costly "down-time". Replacement of standard foot mounted motors is not limited to the original make of motor.

The Philadelphia "Utility" Gearmotor is of heavy, non-corrosive cast iron construction. The rugged design of the motor support eliminates alignment and vibration problems between reducer and motor. These Units are available with motors up to 60 h.p., in full range of AGMA output speeds—they can be furnished from stock for prompt delivery, either with or without motors. The "Utility" Gearmotor is equipped with the patented and widely used Philadelphia "Sphereflex" Flexible Coupling, which provides additional versatility of mounting. Send for complete Gearmotor Catalog, and be convinced.



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Established 1892

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29.6% of all disconnects used were A-B

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RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Illinois
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Mattison Machine Works, Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works., Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St. New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch Tool Corp., Rochester, N. Y
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
H. P. Townsend Mfg. Co., Elmwood, Conn.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wallace Tube Co., (Abrasive) 1304-08 Diversy Pkwy., Chicago 14, Ill.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
American Schiess Corp., 1232 Penn Ave. Pittsburgh 22, Pa.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave White Plains, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Millers Falls Co., Greenfield, Mass.
Thor Power Tool Co., Aurora, Illinois

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SCREW MACHINES, Hand

See also Lathes, Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-Tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York N. Y.

SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York N. Y.
Russell, Burdsall & Ward Bolt & Nut Co. 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page 350*)

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Coolant Pumps
Rugged • Dependable
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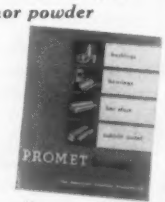

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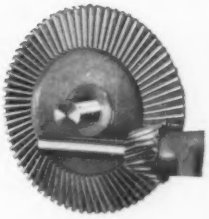

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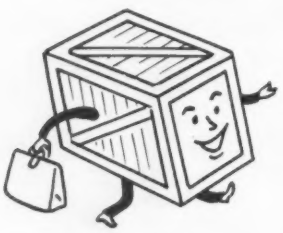
(*Continued on page 354*)



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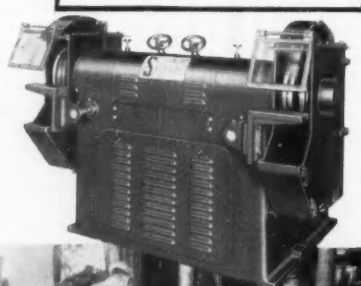

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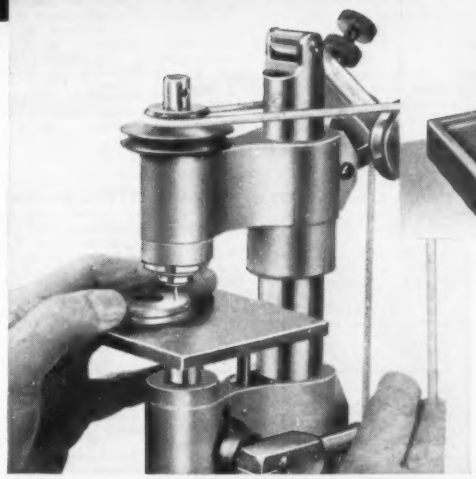

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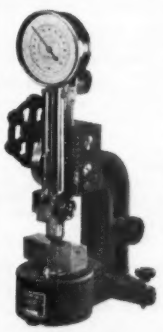

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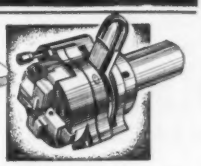

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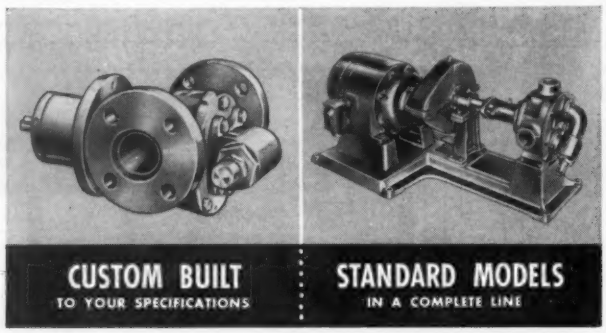

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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge Mass.

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Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
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Vanadium Alloys Steel Co., Latrobe, Pa.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa

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See Alloys, Steel

STEEL BARS
See Bars, Steel

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Starrett, The L. S., Co., Athol, Mass.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

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Sesco, Inc., 8881 Central, Detroit 4, Mich.
U. S. Tool Co., Inc., 225 North 18th St., Ampere, N. J.

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Chicago Screw Co., Bellwood, Ill.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
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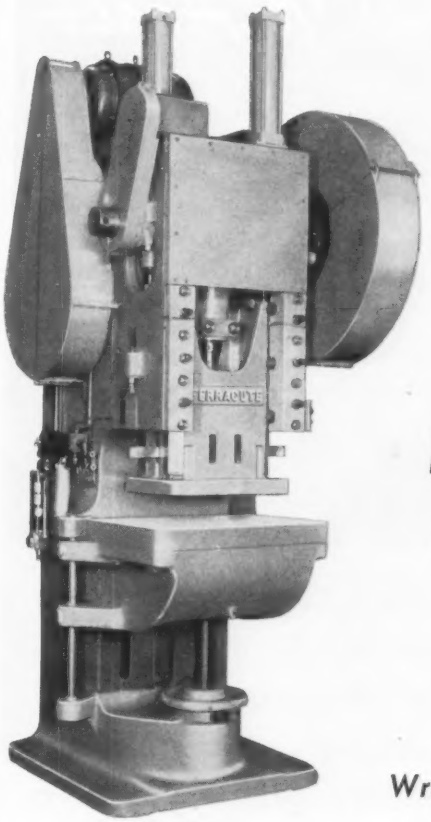
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport Conn.



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Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

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Michigan Drill Head Co., Detroit 34, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
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Lees-Bradner Co., Cleveland, Ohio.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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THREAD GRINDING MACHINES

See Grinding Machines, Thread

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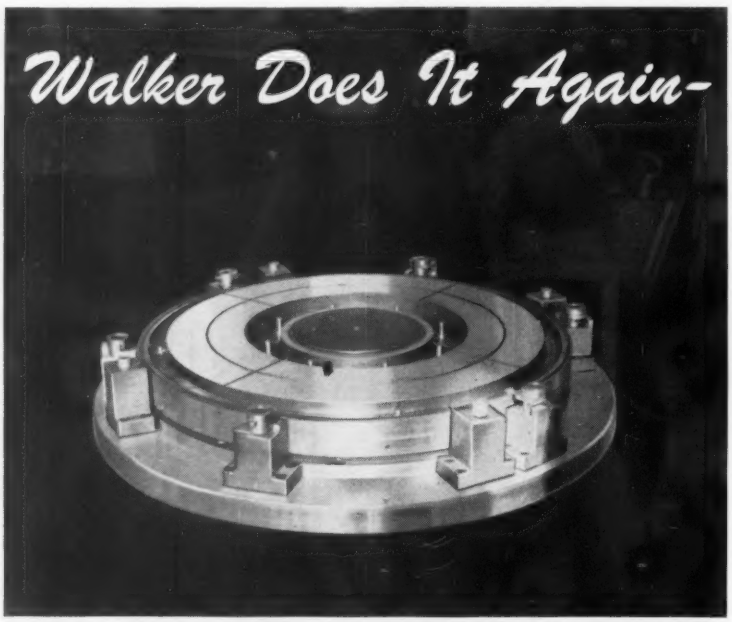

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Cleveland Twist Drill Co., 1242 E. 49th St. Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd Ferndale, Mich.

TOOL CONTROLS

Royal Design & Manufacturing, Inc., 4133 E Ten Mile Rd., Centerline, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening Turning and planing Tools

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
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Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Michigan Tool Co., 7171 E. McNichols Rd. Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St New York 12, N. Y.
Starrett, The L. S., Co., Athol Mass.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 16th St Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Newcomer Products, Latrobe, Pa.
Spiral Step Tool Co., Chicago 25, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Lathrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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(*Continued on page 358*)

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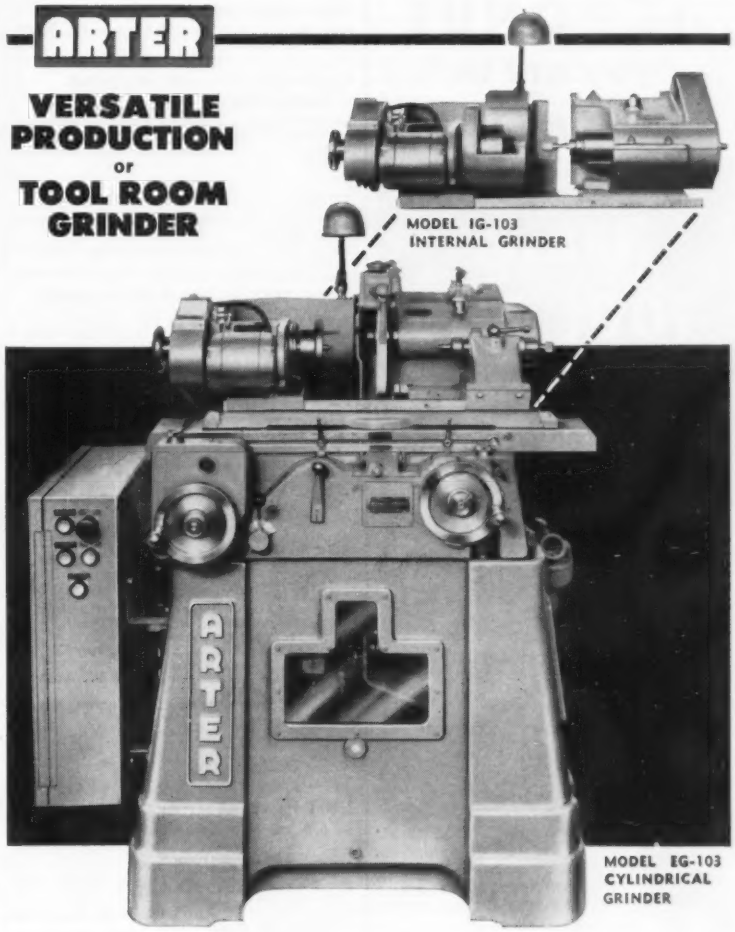

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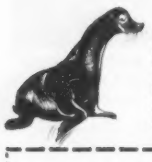

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Bethlehem Steel Co., Bethlehem, Pa.
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National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

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See Drills, Twist

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Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

(*Continued on page 360*)

NOTICE OF PATENT LICENSING

Pursuant to a consent judgment entered on February 28, 1956, in the District Court for the Eastern District of Michigan, Southern Division, in an action entitled United States of America v. Michigan Tool Company, The Fellows Gear Shaper Company, and National Broach and Machine Company, each of the Defendants is required, insofar as it has power and authority to do so, to grant to any applicant making written request therefor a non-exclusive and unrestricted license to make, use and vend under any, some or all of its Defined Patents* relating to gear finishing machines** and tools for use therewith*** and under certain other patents listed in Schedule A of such judgment relating to other types of machines, without any limitation or condition, except that a reasonable non-discriminatory royalty may be charged and except that certain other limitations and conditions set forth in the judgment may or must be included in the license.

The judgment also requires the defendants to furnish to licensees under the judgment at cost, certain technical information for a period of five years.

Upon application being made for a license, each defendant is obligated to advise the applicant of the royalty it deems reasonable for its patent or patents to which the application pertains. If it and the applicant are unable to agree upon what constitutes a reasonable royalty, the judgment makes provision for the fixing of the royalty rate by the Court.

Reference is made to said judgment, and particularly to the provisions of Sections V and VII thereof and to Schedules A and B thereof, for a more detailed statement of the obligations of each defendant and of its patents subject to licensing. The judgment is on file at the Office of the Clerk of said Court, at Detroit, Michigan, where it may be inspected during business hours, or from whom a copy may be obtained.

**As defined in the judgment, "Defined Patents" means United States Letters Patent and applications and patents issuing on such applications: (1) owned or controlled by any defendant at the date of the judgment or under which any defendant then had power to license others and (2) issued to, acquired or filed by any defendant during the five years following the date of the judgment or under which any defendant during such period acquires power to license others.*

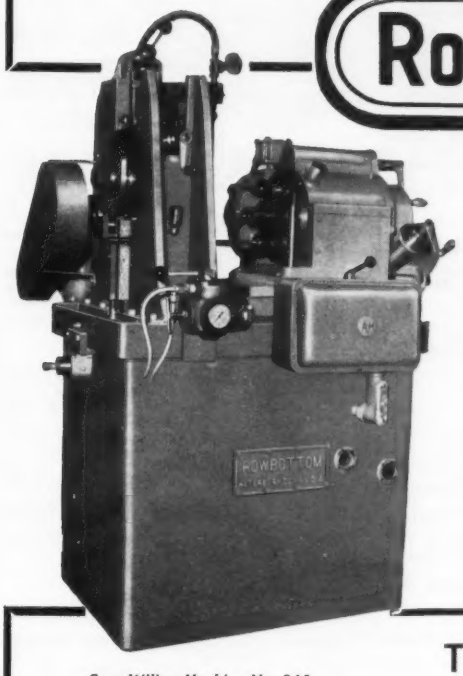
***As defined in the judgment, "gear finishing machines" means any power driven machine designed to finish a roughed-out gear to desired dimensions and which is incapable itself of producing a gear from a blank, and shall include, without limitation thereto, gear shaving machines, gear lapping machines, gear burnishing machines and those gear grinding machines primarily designed for finishing gears.*

****As defined in the judgment in this context, "tools for use therewith" shall mean all types of implements or devices used or capable of being used in or with gear finishing machines.*

Dated as of February 28, 1956

MICHIGAN TOOL COMPANY
THE FELLOWS GEAR SHAPER COMPANY
NATIONAL BROACH AND MACHINE COMPANY

Rowbottom for Cams



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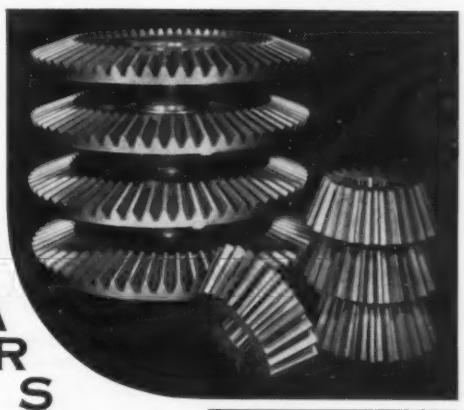

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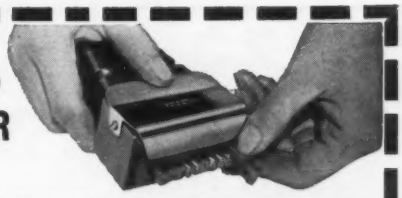

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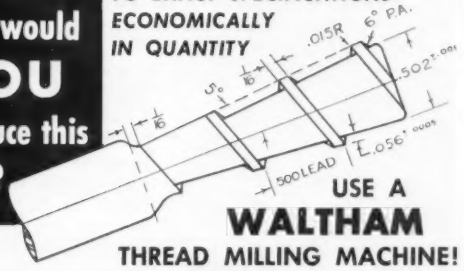

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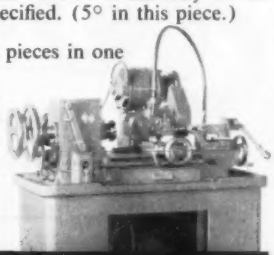

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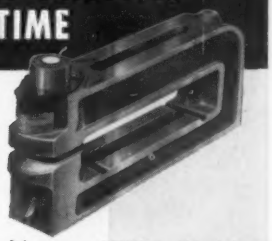

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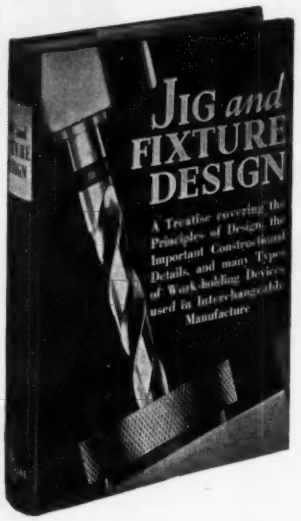
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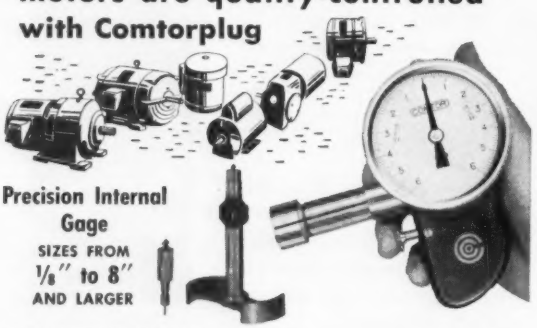

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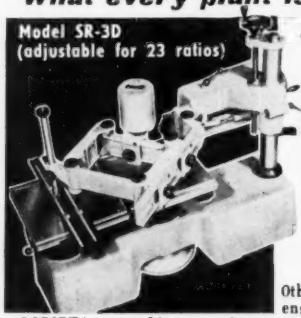

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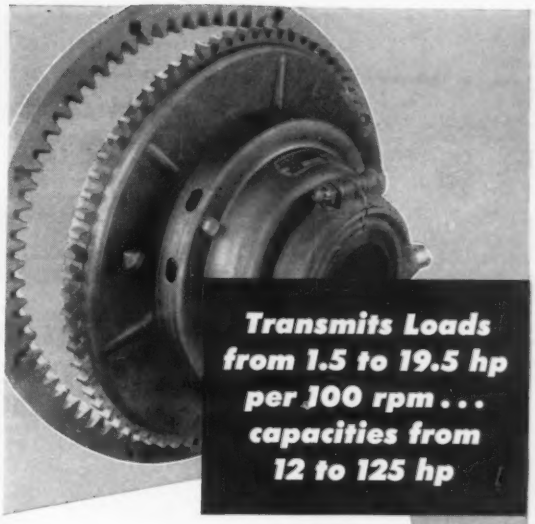

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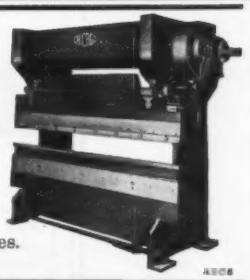

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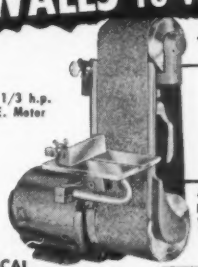

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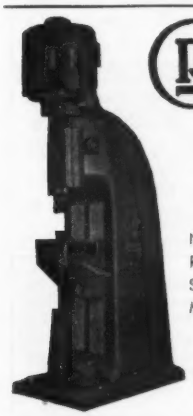

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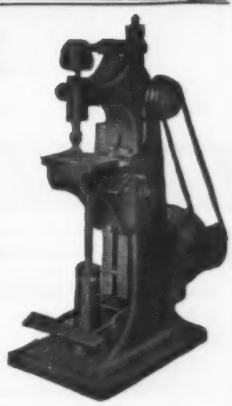

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10x72" Landis, m.d
10x72" Norton, motorized
12x36" Landis Plain Self-Contained, m.d.
12x96" Landis Plain Self-Contained, m.d.
14x36" Landis Plain Hydraulic, m.d.
14x52" Norton, motorized
16x72" Landis Plain, m.d.
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18x72" Norton Type C, mechanical, m.d.
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UNIVERSAL GRINDERS
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12x48" Norton Universal, m.d., latest
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14x72" Cincinnati Model ER, m.d., latest type, Filmatic Spindle
18x66" Landis Universal, m.d., Type C

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25 H.P. U.S. Elec. Tool Co. Heavy Duty Double End, m.d.

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Grand Rapids Tap Grinder, stye 12M
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Grinder, m.d.
No. Lumsden Oscillating Tool Grinder, belted, m.d.
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No. 5T Sellers Tool, m.d.
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Ingersoll Face Mill Grinder
No. 13 Browne & Sharpe Universal Cutter Grinder, m.d.

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Chambersburg 30 ton Hydro-Pneumatic, 13" stroke
No. 6 Verdin, Kappes & Verdin Straight Side Press
No. 4 Stevenson O.B.I. Punch Press, direct geared flywheel drive
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15" Gleason Quench Press

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Gustav Wagner Cold Saw, m.d.
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21A Cochran Bly, latest
No. 3 Motch & Merryweather, 1944
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12"x6' Lodge & Shipley, m.d.
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14"x6' LeBlond, cone
14"x6' LeBlond, Geared Head, s.p.d.
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LATHE, ENGINE, 36" x 156" Monarch "NN", new 1942.
MULTIPLE DRILL, 16 spindle D-20-H Natco hydraulic 3" Dia. spdls., No. 5 M.T., new 1943.
GRINDERS, CYLINDRICAL, 10" x 18" Norton semi-automatic, plunge cut, new 1943.
GRINDERS, SURFACE, 13" x 60" Model 300 Hanchett vertical spindle, new about 1946.
GRINDER, 30" No. 18 Blanchard rotary surface grinder, new 1941.
AUTOMATIC, 1⅝"-6 spdl No. 61 New Britain chucker, serial 25230
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary. new 1946.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom. Timken, 1940.
LATHES, ENGINE, 16" x 30" Monarch, Model CY, new 1942.
LATHES, MFG., Model 10 Sundstrand automatic, front & rear slides, new 1942.
LATHES, TURRET, No. 3 Gisholt universal (2) late.
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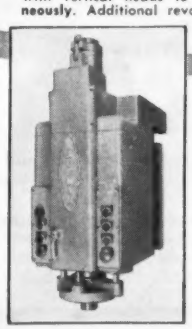

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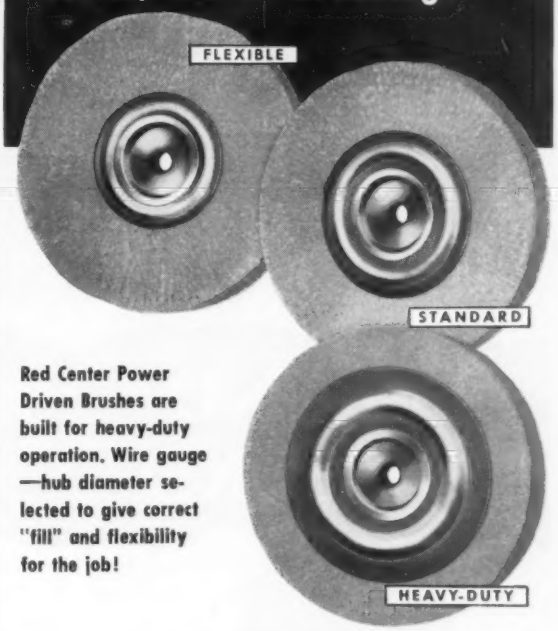

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Pittsburgh Red Center means precision brushing made by uniform "fill" of a specific gauge, quality wire—mounted in a specially designed hub to give exact brushing surface and strength required. With all these features you're assured of longer brush life, faster cutting, finer finishing.

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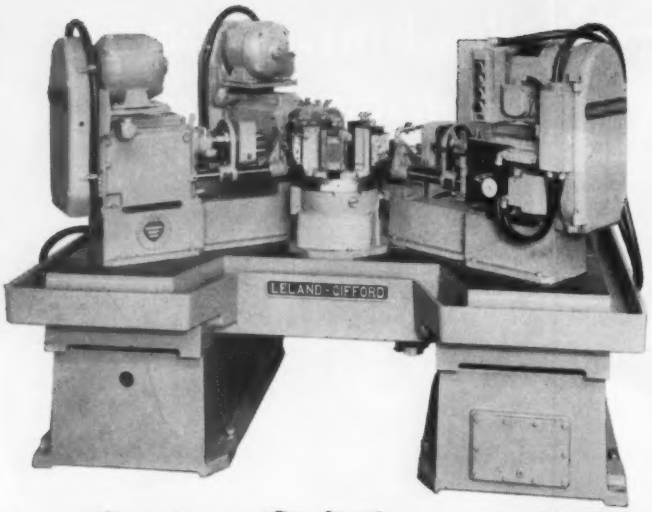
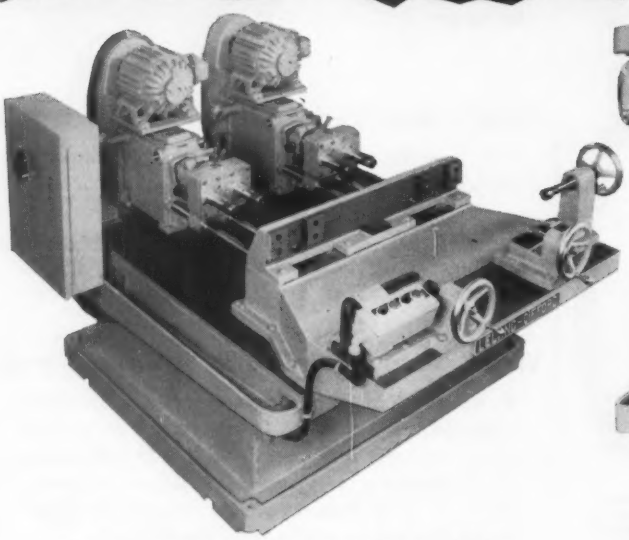


Mechanize Hand Operations

THE JOB — Drill and ream four holes on the face and two ends of automatic transmission valve body.

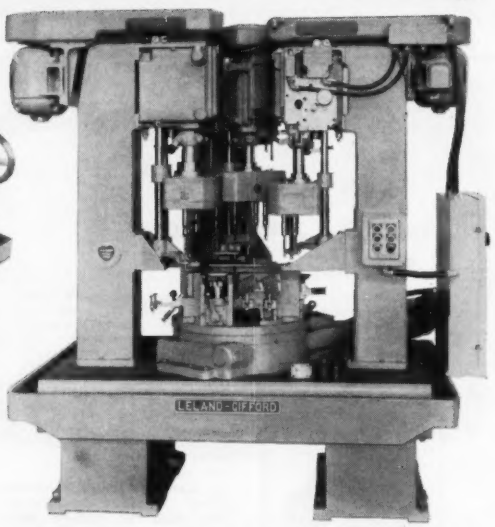
THE SETUP — Three No. 2 self-contained deep hole units with 2-spindle multiple heads and a 5-station hydraulic indexing station. Production: up to 120 pieces per hour.

LELAND-GIFFORD *Special Drilling Machines*



THE JOB — Drill and ream two .750/.751 dowel holes in 4 and 6-cylinder engine blocks.

THE SETUP — Two No. 3 self-contained units with 2-spindle heads mounted on a special base with work holding and positioning fixture.



THE JOB — Drill and ream 9 holes in one face and 2 deep angular holes in one side and one end of a control valve housing.

THE SETUP — One No. 3 and two No. 2 self-contained units with multiple heads vertically mounted over a 2-station automatic indexing table.

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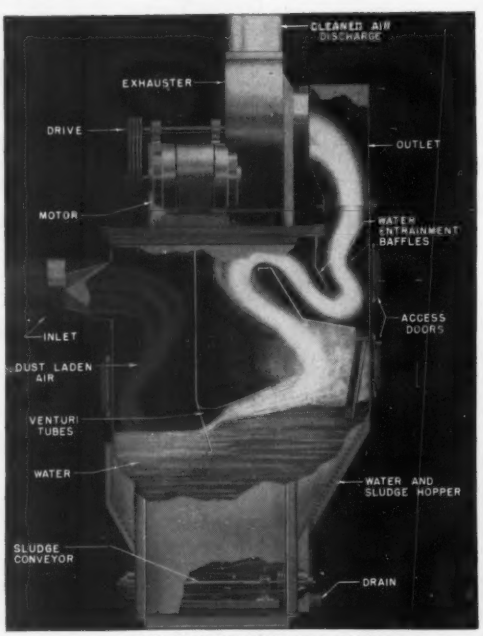
NOW—Great news about two new Pangborn Dust Collectors!



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These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard., Hagerstown, Maryland.

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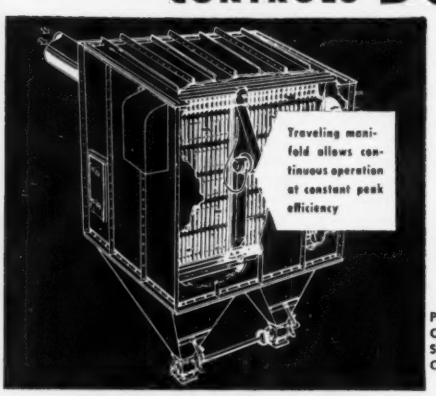

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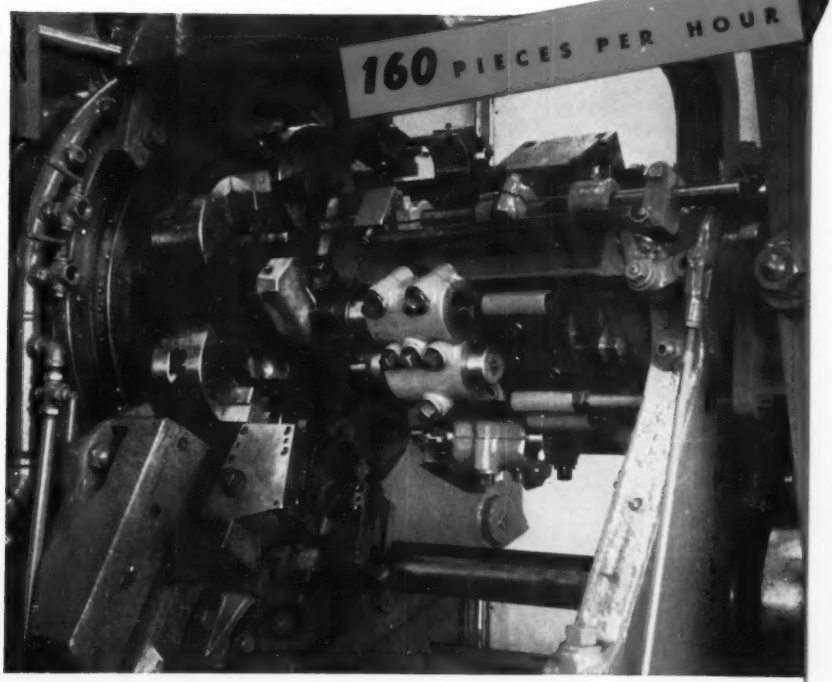

FIRST PASS:

Work is placed in chuck equipped to receive the unfinished casting. Outer end is then rough-and-finish turned on OD (allowing for grinding); ends are faced; spherical seat rough-and-finish turned; centering seat chamfered and turned, and shoulder diameter turned concentric with OD. Groove cut concentric with OD.

SECOND PASS:

Work is turned around after return to loading station and placed in adjacent chuck, unfinished end out, and passed through machine for the same operations. The parts are then separated.

TOOLING: This Baird 76H Chucking Machine is arranged for single indexing with alternate chucks for rough-and-finished ends of the work, two-station live-center attachment, adjustable tool holder for use in machining three different sizes of pistons, and with alternate cycle cut-off.

If your production could benefit by up-to-the-minute, cost-saving "automation" tooling like this . . . "Ask Baird About It."

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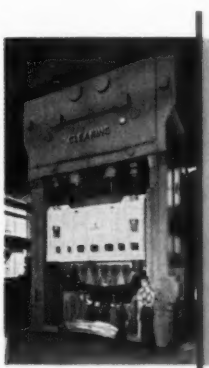
THEY'RE Really JUDGING

YOUR PRODUCTIVE EFFICIENCY

When people are deciding what they want to put out their hard-earned money for, they take a pretty careful look and make tough-minded comparisons. What they're really judging, perhaps without consciously thinking of it that way, is the ability of the manufacturer to produce efficiently. Other factors being equal, the manufacturer who can put more into his product for the money gets the biggest share of the nods.

LET CLEARING HELP YOU MODERNIZE FOR HIGHEST EFFICIENCY

If your product is made from stamped metal parts, Clearing engineers can help you produce at a lower cost. They'll tell you about recently developed presses, that run twice as fast as conventional machines, they'll discuss methods of cutting down in-process material handling. To meet the challenge of tomorrow's market place, modernize your manufacturing setup with truly modern equipment. Call a Clearing man today. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois. Hamilton Plant, Hamilton, Ohio.



These Clearing presses provided an improved production method for a prominent automotive parts manufacturer. Details on request.

Write for Clearing brochure "Thinking of a better way to do the job?"

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

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